WINTER 2023

The Nature of Trees

Arnoldia

The Forest of Molecules

Beech Leaf Disease

Trees of McLean

The Loss of an Ailanthus

Balm for a World of Wounds

By Matthew Battles

The morning of her operation, my wife Rebekah decided that she wanted to bicycle to Faulkner Hospital, which stands little more than a mile from our neighborhood across the Arboretum. And so we packed up her overnight things and pedaled off toward Faulkner: through Bussey Brook Meadow, where frost whitened the relic reeds and the bare boles of *Ailanthus* creaked bonily in the breeze; onward up Valley Road, huffing and pedal-mashing past the magnolias still bare of their big leaves; and out through the Centre Street Gate, toward whatever was to come.

Ever since, passing this way triggers a welling of memory—my fear, her grit, and the shadowing trees. It seemed at the time as though cancer had declared war on our family: in quick succession, Rebekah, her sister, and my father were struck with diagnoses. Only Rebekah survived; she's now fifteen years free of recurrence. I won't say the trees made the difference, though I wouldn't have wanted to face any of it without them.

After a recent surgery of my own, a morning walk in the Arboretum became my post-operative routine. The conifer collection was my special balm; as the days warmed and my stamina increased, I sought the secret chambers of the yews and the touch of the giant sequoia's softly resonant bark. I wandered among the spruces crowded with new cones, releasing their pollen in cloudy sheets that sieved the sunlight as they drifted downslope. These gymnosperms, great survivors of life's tumbling epochs, treasure hope and healing in their everlasting green. This medicine isn't metaphorical: the air amid trees is vibrant with enlivened chemistry; their pigments tickle deep-rooted centers of neural appeasement; their fallen needles cushion every recuperative step. It's a fast-acting pharmacopeia, with no unwanted side effects. I don't believe it's possible to overdose.

Since those convalescent days I have treasured my walk to work, incorporating encounters with the collection into my commute. A long-dormant case of sciatica recurred over the summer, however, taking away my walk with its wild, thickening pain. I tried describing it to a nurse who was contemplating a list of keywords: "it feels like I have an arrow buried in my back," I said—"okay, that's *Stabbing*," she replied—"and there's like a bare wire running down my leg"—"that would be *Shooting*," she continued. *"Shooting and stabbing?"* I repeated. "I'm a crime scene!"

Keywords missing from the nurse's form: *Instability. Fragility. Hollowness. Uncertainty*. Words for the psychic impact of pain, its cosmic extent—the way it narrows your mind, crowding out the questions that usually enliven you. Standing and walking brings out the worst of my pain, but sitting appeases it. This relief carries over into cycling, and so I've taken to biking again, a gift of miraculous, swift, pain-soothing mobility.

Yesterday, I set out on my bicycle for the oak collection. With a kindling curiosity about the history of Oklahoma's oilfields, I was looking for specimens of blackjack oak, *Quercus marilandica,* a scrub oak found across the southeastern quarter of North America. Along the Texas-Oklahoma state line, it comes together with post oak and a wild variety of shrubs and other plants to form the "Cross Timbers," a savanna ecosystem of great age and complexity interlacing the oilfields.

Heading out from Hunnewell along Meadow Road, I pedaled through the invisible patisserie of the katsuras still pumping out their caramel fragrance; turning at the ponds, I climbed Bussey Hill Road past the lemon-lime foliage of the redbuds, under towering sassafras trees with mitten-shaped leaves, and turned down Valley Road past the bitternut afire with fall to its topmost height. Here I slowed, scanning for the particular blackjack specimens I sought.

The plant-record database lists twelve living trees distributed around the landscape, including one on Peters Hill that was accessioned in 1895. The specimens I sought in the oaks collection are younger, collected from the wild in 2018 by Tiffany Enzenbacher and Kea Woodruff during a collecting trip to Cross Timbers country near Tishomingo, Oklahoma. They're saplings, only recently planted out, and still surrounded by protective cages of wire. *Q. marilandica* is sometimes called duck-foot oak, and I delighted at the comical webby footprint of the saplings' still-green leaves, with which my imagination paddled off uncertainly toward the Great Plains.

And my pain? It hadn't disappeared, but for a moment it felt right-sized on that vaster map. The analgesic effect of trees is compounded not only of chemistry, but curiosity.

The analgesic effect of trees is compounded not only of chemistry, but curiosity.

Earlier, I said that it felt like cancer had declared war on my family. The metaphor feels fraught now, with the enormity of the war on Gaza growing daily. Recently, I received a pitch for an article from a young journalist proposing to write about West-Bank olive groves and the Palestinian farmers who tend them. I replied to his email, suggesting a January deadline. The day was Friday, October 6. A couple of days later, with the horrors of that weekend still emerging, he wrote again, asking for reprieve from the January deadline, with the hope that peace would come and he could return to the olive groves. I begged him to be safe. As I write this morning I see his byline from Tel Aviv, where he is covering the war.

Is there no balm in Gilead? the prophet cries in Jeremiah. *Is there no physician there?* Scholars believe the biblical balm was Storax, which Wikipedia describes as "a natural resin isolated from the wounded bark" of sweetgums. As for Gilead, it was a land that lay close by the River Jordan. We live in a world of wounds—and we share it with trees.

I expect the story of the olive groves will have changed by the time peace comes and the next normal is found (may it be soon). The malignancies of hate and fear, of war and unspeakable grief—I know that trees can't take these away. I also know that there is no peace without them. Some of the West Bank olive trees are five hundred years old, after all. Think of all that those trees—and their caretakers in hope and in grief—have witnessed and withstood.

MATTHEW BATTLES *is the editor of* Arnoldia. *He is writing a book about the natural history of memory.*

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Forest pathologist Robert E. Marra tracks the destructive path of beech leaf disease in the woods of Connecticut. *Photograph by Angela Chen*

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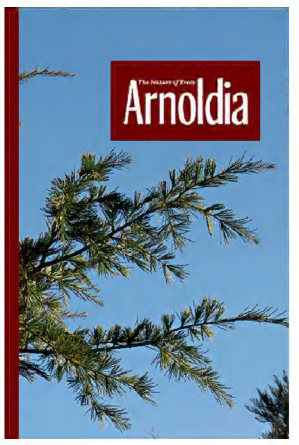

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Discovering Fire

In the fall of 2023 issue of *Arnoldia's* Notes from the Field section, four plant investigators discuss their collection of seeds from burned forests ("Searching Siskiyou," page 6). Their writeup gave me great pleasure because they explained the value fire plays in the maintenance of forest ecosystems. It reminds me of how far we have come in our understanding of the ecological value of fire in the last 50 years.

During the late 1960s and early 1970s, I was part of a small group of people trying to have the need for fire in the landscape accepted. Most people viewed fire as a destructive force and few agreed with us. The opposition was pervasive. We ultimately received approval from the Chief of the Forest Service to allow naturally occurring fires in the Selway Bitterroot Wilderness, and in 1973 I approved the first such prescribed fire to burn. This fire burned 1200 acres, and since that time, hundreds of such fires have been allowed. The research that has occurred as a result has changed how we suppress and manage the use of fire worldwide.

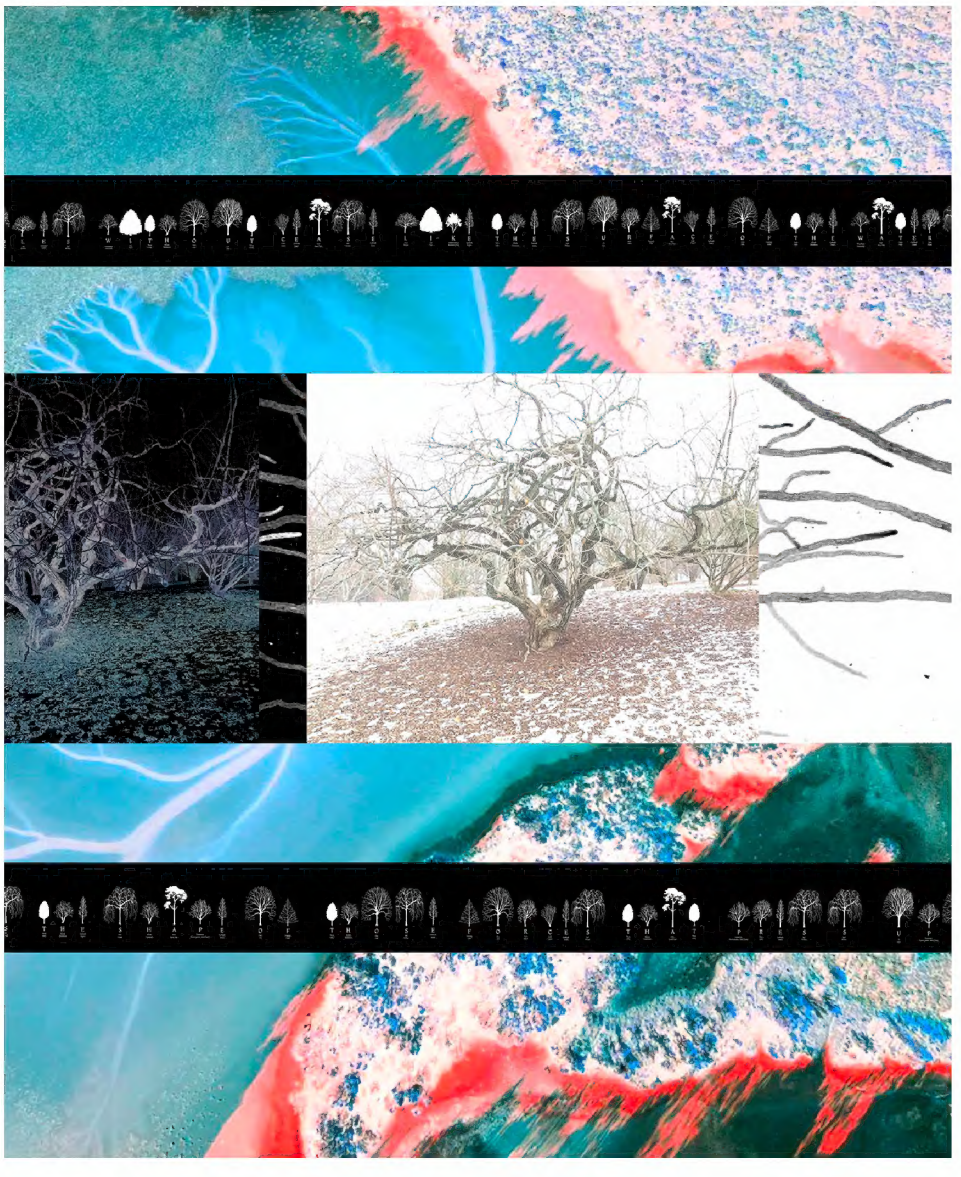
The growth of knowledge and relationship to fire as an ecosystem force is profound, although the battle for acceptance of these facts continues today. To hear these professionals express a full understanding of how fire can be a regenerative force rather than simply a destructive force gives me hope.

Orville L. Daniels
Forest Supervisor (retired)

Genetic Diversity in the Garden

I recently enjoyed your interview, "Sean Hoban on Genetic Diversity and Diplomacy" (Fall 2023). I appreciate Sean's insights into how the Convention on Biodiversity affects the challenges faced in securing and accessing plant germplasm. The discussion of how botanical gardens should consider genetic diversity in collection development in particular caught my attention. Sean's point about gardens taking the preservation programs of other gardens or nurseries into account when acquiring plant germplasm is well taken; a shift towards supporting or creating new collections, rather than replicating existing ones, could indeed significantly advance the preservation of plant genetic diversity. The horticultural and scientific community should consider whether collectively across public gardens and seed bank repositories the potential or ability exists to address any future restoration projects or the critical need of repatriation. Most woody plants have unique ways to ensure outcrossing, like dioecy, prefertilization mating barriers (self-incompatibility systems), and dichogamy. Sean's suggestion to explore mating individuals across botanic gardens is intriguing, especially for species with limited accessions. Yet, executing a "reunion" of plants in order to achieve the production of seeds is an extremely challenging and daunting task. Thus a strategic movement towards planting "population-based" collections, as practiced at the Dawes Arboretum, coupled with the reduction of duplications via the acquisition of new accessions of a species, will drastically increase the ability to have the genetic diversity needed to perform and persist in the landscape.

Jeffrey D. Carstens
The author is a federal scientist stationed in Ames, Iowa.



CURRENT

Pursuing Reality: Possibilities

A meditation on nature, networks, and connectedness—these are some words to describe "Pursuing Reality: Possibilities," a series by Jo-Anne Green, on view in the Hunnewell Visitor Center until February 18, 2024. In this collection of photographic collages and digital prints, the artist highlights the connections between patterns and networks in nature and the human brain. Using images scavenged from the internet, Green's own photographs from the grounds of the Arnold Arboretum, and featuring Katie Holten's Irish Tree Alphabet (featured in *Arnoldia's* Winter 2022 issue), this exhibit is not one to be missed.

Hyphae & Streams (detail) by Jo-Anne Green

Notes from the Field

Darwin's Endangered Fantasy

Daniel Faccini revisits the botanical wonders of the Canary Islands, pursuing the story of their evolution—and reflecting on their endangered beauty.

Daniel Faccini is a Colombian botanist and doctoral student in Ned Friedman's Plant Morphology Lab at Harvard University.

Years before the *Origin of Species,* the barnacles, the stories about moths and orchids, and even before stepping into the *Beagle* to sail around the globe, the young Charles Darwin could only dream about the natural wonders of the tropical world. Of his dream travels, the first one, an island near the west coast of Africa, would come from the pages of Alexander von Humboldt's diaries. "All the while I am writing now my head is running about the Tropics: in the morning I go and gaze the Palm trees in the hot-house and come home and read Humboldt: my enthusiasm is so great I cannot hardly sit on my chair ... I never will be easy till I see the peak of Teneriffe and the great Dragon tree; sandy, dazzling plains, and gloomy forest are alternately uppermost in my mind." He would never get to the islands, however. The year he wrote this passage, he missed the boat bound for the Canaries. Years later, while aboard the *Beagle,* he could only glimpse from a distance how the peak of Mount Teide rose above the clouds of Tenerife, as a quarantine denied him the chance to set foot in his dreamland. "I must have another gaze at this long wished object for my ambition. —Oh misery, misery.... We have left perhaps one of the most interesting places in the world, just at the moment we were near enough for every object to create, without

Illustrations by Matt Huynh

satisfying, our utmost curiosity." What did Darwin miss?

I first saw the peak of Mount Teide on a sunny afternoon in the last days of May. As my plane flew around Tenerife, a dark, enigmatic volcano rose above the clouds through my window, a colossal presence that marked the beginning of the first field season of my Ph.D. work. It appeared as two islands in one, one emerging from the Atlantic and the other rising from a white ocean of clouds. Far from being a uniform landscape, a geography of dramatic fractures and ridges spanning a vertical gradient of more than ten thousand feet conveyed the feeling of a vast corrugated continent rather than a small and remote island. Just outside the airport, the plants I had been reading about for months started leaning out from the nearby gorges. Dandelion trees, woody daisies, and the *Echium* shrubs branching like towering candelabra made a short drive into an hours-long journey.

Every time I asked about a species, he would close his eyes as if embarking on a mental journey across the island.

I was there to find answers to a question that Darwin himself outlined: why is it that all around the world, small, herb-like continental plants evolve into Seussian-looking shrubs and trees when they colonize islands? It was the well-studied yet unapprehended *Echium* or dragon tree that brought me to the archipelago, and it was through its diversity of forms and insights from decades of past research that I hoped to unravel the puzzle. Surrounded by these plants as I drove around the island, my perplexity only grew. Of these memorable encounters, the most mythical came when I stumbled upon a dragon tree as the sun was about to set. Its heavy trunk stretched to the sky, forming an umbrella of bifurcating branches, and its glossy bark—closer to the scaly skin of a reptile than that of a plant—was topped with long green leaves as pointy as spears. Yet if the tree ever awakened as a dragon, I thought, it would probably be a gentle, slow-moving beast. I spent the night in La Orotava. The next day, I would meet the director of the local botanical garden, the great Canarian botanist Alfredo Reyes.

When I entered La Orotava Botanic Garden, I felt transported to the time I lived in the buzzing dry forest of the Colombian Caribbean. The garden had once been a mandatory stop during European explorations, where most tropical American plants were grown before continuing their journey to the greenhouses in continental Europe. The collection was full of plant species that, for some time, had only been growing in my memory. I greeted these relatives of my old companions and followed Alfredo to his office. A tall man, he navigates delicately through space, pauses briefly before answering a question, and often points out something in the surrounding vegetation. His office was that of an old-school botanist: newspapers with rare plants everywhere, curious fruits and seeds standing in wooden cabinets packed with floras, and botanical plates and engravings hanging on the walls. I met his colleague and former student, Miguel Padrón, and discussed *Echium* and the expedition. Every time I asked about a species, he would close his eyes as if embarking on a mental journey across the island before sharing the names of one of the many *barrancos* (gorges) or even some coordinates. "You can find that plant there," he said. I smiled. During the first few days, I would be on my own, with Alfredo and Miguel set to join me later in the week. I looked at my notes in the field notebook: a list of names of places I could barely imagine. I left his office. I had no doubt which plant was the first one in my quest.

I drove through the dry vegetation near Puerto La Cruz, then went up to La Orotava town and took the road to Las Cañadas del Teide. The greenery that at first was closer to tanned yellow rapidly transformed into a dark green, and the short shrubs turned into trees. I noticed how the car windows collected drips of water until I was surrounded by fog and could barely see the heather trees and the *fayas* (*Myrica faya*). Only the gleaming red trunks of the *madroño canario* (*Arbutus canariensis*) struck like flashes of lightning in the humid veil that had enclosed me. I followed the narrow road as it ascended further into the mountain, soon finding myself immersed in a Canarian pine tree forest. This distinct forest was

brown in color. Trunks and dead pine needles framed a sparse understory with a fresh scent. In less than an hour, I had traversed three completely different ecosystems, the boundaries between them so clear that I felt like I was traveling *between* islands and not *within* the confines of a single one.

I soon left the pines behind, and the fog opened to a desolate horizon of volcanic rock with some sparse green spots and white broom flowers that inundated the air with a delicate-sweet smell. And there it stood! A giant rosette of silver and furry leaves erupted in a single eight-foot-tall column of ruby-colored flowers: *Echium wildpretii,* the iconic *tajinaste del Teide,* in full bloom. My delight persisted. Once you see a plant, you cannot *unsee* it. You engage in a relationship with it as it becomes ingrained in your imagination, and you start recognizing it wherever it grows as if a new layer of the world has come afloat. Even if you forget the name, you will always acknowledge how it looks—its overall impression, what Goethe called the *Gestalt*. Along with a botanical press, seed bags, and my red pruners, it is the *Gestalt* of the plants I have known in the past that I carry most dearly to the field. This is how I navigate the world to find them.

Along with a botanical press, seed bags, and my red pruners, it is the Gestalt of the plants I have known in the past that I carry most dearly to the field.

Alfredo and Miguel guided me on my last day in Tenerife. We drove to the island's northern gorges through a dense and humid laurel forest with trees covered by a mossy layer and a fern understory that reminded me of Darwin's dreams. The forest rapidly yielded to a drier, Mediterranean-like shrub ecosystem. We parked and started hiking. We walked until we reached a northern-facing slope, the only place where the *arrebol tajinaste* (*Echium simplex*) grows in the wild. We sat on the edge of a cave shaped by millions of years of erosion. In front of us, the land suddenly sank a few hundred feet into the blue Atlantic. Alfredo and Miguel started showing me the endemic species growing there and the count quickly went up to thirty. In that piece of land, small enough that we worried about making a misstep and falling to our deaths, thirty plant species that grow nowhere else in the world happily bloomed. I could almost see the evolutionary tree branches sprouting here and there! This evolutionary exuberance is what Darwin missed, I thought. An island where so many perplexing evolutionary stories of plants unfold before our eyes—a place rightfully called "The Galápagos of Botany."

Yet, this is an endangered beauty. We live in the time of now-or-never for our biological studies on the islands. Every species extinction is an irreplaceable loss of information, one lost word in the history of life on Earth. The Canary Islands hold many cues to understand how small-herbaceous plant lineages evolve into tall trees and shrubs and how the stunning diversity of plant growth forms has come to be. But most endemic species are in great peril and, with them, the depth of our understanding of life. As I write this, a wildfire that has burned over twenty thousand acres on Mount Teide still rages. Many trails I walked earlier this summer, collecting mesmerizing plant species, have vanished amid ashes and smoke. How many plants have been lost to the flames? Enough to think that if we fail to do something about it, not only Darwin, but the generations to come will miss the unique organisms that inhabited these islands long before we did.

Plump-full of Plumleaf

Connor Ryan scouts *Rhododrendron prunifolium* along the Georgia-Alabama state line.

Few people would choose to travel to the deep South in August—the bugs, heat, and humidity are simply no fun. But if you wish to see one of North America's most uncommon azaleas in bloom in the wild, that is when you must go. As part of an ongoing project to modernize the Holden Forests and Gardens rhododendron and azalea collection, we embarked on a trip to scout the plumleaf azalea (*Rhododendron prunifolium*) during the week of August 7–11, 2023.

The plumleaf azalea is one of the rarest rhododendron species in North America, occupying just a small area on either side of the Georgia/Alabama border along tributaries of the Chattahoochee River. In addition to being rare, it is a worthwhile garden species, one of very few native azaleas to bloom in July or later. Flowers are typically orange-red and tubular, favorites of swallowtail butterflies and hummingbirds. And the species is deceptively cold hardy, surviving and blooming following temperatures below -20° F with ease. Our program at Holden Forests and Gardens' David G. Leach Research Station also has ties to the species. David Leach received seed from S. D. Coleman, the pioneering nurseryman from Fort Gaines, Georgia, for whom the Red Hills azalea (*Rhododendron colemanii*) was named. In respect and gratitude to Coleman, David named a selection of plumleaf azalea in his honor, and we have the original 1951 plant still in our collection.

The plan was to meet up at the Atlanta airport. Our team was comprised of me and Jing Wang, both from Holden Forests and Gardens, and Trevor Schulte, horticulturist at Morris Arboretum and Gardens. I had a list of historic sites we had permission to

Connor Ryan is the manager of the *Rhododendron* collections at Holden Forests and Gardens in Kirtland, Ohio.

Illustration by Matt Huynh

visit, and our plan was to get to as many as possible. We simply wanted to make a rough accounting of their health and size, and collect observations that could inform whether we might return to collect seeds.

To orient ourselves at the beginning of the trip, we spent Monday morning at Providence Canyon State Park, the most famous site to see the plumleaf azalea. It is so well-known that the azaleas and canyons are the image for the Georgia U-Haul. There are indeed thousands of plants there, with the classic red-orange flowers dotting the steep slopes and sides of streams in the park.

We spent the rest of the week tromping through the woods, wading through shallow streams, and keeping our eyes peeled for the orange-red flowers suspended at about shoulder height or higher. Our first stop on Tuesday was to be the River Bluff Recreation area operated by the Army Corps of Engineers just across the bridge from Eufaula, Alabama. We were dismayed to find a large, orange "Road Closed" sign across the entrance, so we continued to our next site, just a bit south. While there, I made a call to our contact at the Corps of Engineers, Sarah Jernigan. She said the bridges into the site had been condemned, and she pointed us in the direction of a local man named John Pritchett. John would later become an essential element of our story.

How extensive would a collection need to be to capture the genetic diversity of the species?

After successfully finding the azaleas at the current site, including a plumleaf azalea easily over twenty feet tall, we stopped for gas back near the River Bluff area. A booming and persistent late afternoon thunderstorm left us stranded in a gas station parking lot hoping the storm would reside. Finally, after 45 minutes, there was a gap in the radar, the rain had lightened, and we took our chance. We headed to our last site of the day, a stream-accessed roadside in northern Quitman County, Georgia.

I called John on Thursday, and he met us at River Bluff that afternoon. John, who as far as I could tell had no official connection to the county outside of a stint as school superintendent some years ago, had an incomprehensible amount of sway, allowing us to access the River Bluffs area after all. He was responsible for the "Road Closed" sign being erected. It turns out John was a fan of the plumleaf azalea and had an intimate knowledge of nearby populations. When we met, John led us to the River Bluffs population, telling us how he had shown Sarah this population as well and that it was just along the stream running through the park. He let us go off into the wooded stream to poke around.

While walking with John, we discussed other sites nearby—Bustahatchee Creek, Cool Branch, a spot off Highway 39 on land owned by local conglomerate W. C. Bradley. We mentioned a run-in with the police a couple days prior, when we stepped out of the woods only to find blue flashing lights pulled behind our white, mid-sized SUV with a Florida plate. After explaining to the officers that we were just looking for plants, and after they explained that I did a terrible job parking our car and that someone reported it abandoned, we were on our way back to our evening accommodations. When I told this to John, his eyes lit up, and he smiled. John then revealed to us that it was he who had called the cops. John lives at the end of the road we parked along. At this point we all cackled at the coincidence.

After further discussion about plumleaf azalea populations, John pulled out the holy grail: a 1988 report by James R. Allison from the Georgia Department of Natural Resources documenting every known population of the plumleaf azalea. I asked John where I could get a copy. He said, "Give me your address, and we'll mail a copy to you." I did, and a week later the report showed up at my house.

While habitat destruction by humans seems always to be a key component in the demise of many species, deer and wild boar may be the greatest threat to the plumleafs. Many plumleaf azalea populations I have visited (around 15 at this point) have been spared from logging and other habitat destruction due to the ankle-breaking slopes and streams on which they reside. This tracks with the report John shared with us, which states "that *R. prunifolium*

is a species not in the least threatened with extinction within the foreseeable future." In our time down south, we noted that invasive species were uncommon in the core of the populations we visited. Deer, however, prevent the plants from regrowing, leaving only the oldest, mature stems to persist until they can no longer. We saw plant after plant with new shoots chewed to deer-head height. Boar also likely keep seeds from germinating and seedlings from thriving. Extant populations appear static, waiting for relief from browsing and boar, and I feel these are serious threats given the narrow geographic range of the species.

Sometime along the trip we all remarked that we were simply taking the same photos at each site, as there is some, but not much, floral variation among the plants and populations. We were able to find flowers in pure orange, pure red, and tinted pink, but by and large most plants had the classic orange-red flowers. There was also little variability in size and shape—most plants were quite large and spreading, maybe 10-15 feet in height and somewhat narrower. This raises questions of genetic diversity: How genetically distinct are the populations? And from a botanical garden collection point of view, how extensive would a collection need to be to capture the genetic diversity of the species? I wish we had those answers as we explored each site.

After visiting ten populations over the week, our last stop was Callaway Gardens, whose logo proudly displays the flower of the plumleaf azalea. Having started our trip at Providence Canyon, the most famous wild site for the species, we ended in a famous garden collection where extensive plantings of the plumleaf azalea serve as a template for what we could accomplish at Holden Forests and Gardens. The following day, we returned to our respective institutions after a week in the woods. I had a new anklet of chigger bites, had lost many pounds in sweat alone, but ultimately felt fulfilled—and ready to formulate a plan to return for seeds.

PETR KREJČÍ PHOTOGRAPHY

STEWARDSHIP

Menominee Forest Management

What images does the phrase "managed forest" evoke? An internet search returns pictures of row upon row of monotonously similar trees, all the same species, spaced at regular intervals. A prime example of management that breaks the conventional mold can be found in the Menominee Forest in northeastern Wisconsin. Located on the ancestral lands of the Omāēqnomenew-ahkew and Očhéthi Šakówiŋ, the forest covers 93 percent of the 235,000-acre Menominee Reservation. Since its creation in 1854, the Menominee Forest has been nurtured through indigenous practices; as Fred Pearce writes in his account of the forest and its indigenous stewards for *Yale Environment 360*, the tribe's stewardship is "underpinned by their cultural and spiritual traditions, conveyed by their ancient language." Today, it boasts more than one billion trees, many over 150 years old. Despite active logging for more than a century, there are approximately 40 percent more trees today than in the past. How do the Menominee do it? They maintain diversity and integrity by removing the weak, sick, and dying trees, leaving the healthy ones to reproduce and create the next generation of offspring. No additional trees are planted—the forest regenerates naturally. This runs counter to most traditional forestry practices, yet its success is evident. The stewards of the Menominee Forest blend tribal knowledge with ecological science to maintain a thriving, resilient, and abundant forest. According to the head forester, "Our logging schedules and management are purely for the forest."

—Jamila dePeiza-Kern

From the River to the Road

Izzy Acevedo seeks *Phlox,* and questions, in the Texas Hill Country, returning to the laboratory supplied with both.

Izzy Acevedo is a research technican in the Hopkins Lab at the Arnold Arboretum.

It's my second field season in central Texas, and this time I have the confidence and savvy that comes with a little bit of experience: I know how to watch out for the bull nettle and the fire ant mounds, which could leave me in blistery pain for days; I know the particular flick of the wrist it takes to catch *Battus philenor,* our favorite pollinator, in a butterfly net; I know the approximate length of time we can hover on a roadside looking for *Phlox* wildflowers before a concerned Texan property owner comes out to question us. Such are the markings of a Hopkins Lab field scientist.

Each morning, fueled by coffee and breakfast tacos, we hit the road in search of *Phlox.* We follow maps cobbled together in evening sessions on the couch, copying coordinates of sightings logged by our lab predecessors and the larger community of observers on iNaturalist. Some of these points lead us into fenced dead ends and unlikely ditches, but at other spots we are rewarded with the sight of pink poking up through the green and brown of the roadside. We greet the *Phlox* and their usual cohabitants with the joy of meeting old friends, the familiar firewheels and paintbrushes, the pinkladies and the yarrow.

There are friends to be made with caution, too, crouching in these overgrown ditches at the wild margin of ranch and road. We tiptoe around teetering piles of rotting juniper wood, a humid home for stinging scorpions. We carefully skirt a rattlesnake coiled defiantly on the hot asphalt of the emergency lane. We play frogger with passing trucks to save a few turtles making their way across the double-yellow.

Key to our interest in one *Phlox* species, *P. drummondii,* is the spatial gradient along which its color changes from light blue to dark red, a key adaptation that prevents its cross-pollination with highly similar species *Phlox cuspidata.* We drive this cline until swathes of bluish-purple turn into a patchwork of dark plum and pale pink and finally to a deep rose red, the same species looking a sister to purpletop verbena and blue-eyed grass and scarlet sage within a couple of miles.

Everywhere we find *Phlox,* we are followed by the fluttering shadow of the pipevine swallowtail, *Battus philenor.* We watch as it gently alights on purple flower after purple flower, pausing the beat of its wings to kiss the opening at the center of each corolla, graceful and methodical as it dives for nectar with its pollen-covered proboscis. It is easy to see how a choosy butterfly moving only between flowers of the same color would no longer transfer pollen from a light blue *Phlox cuspidata* to a dark red *Phlox drummondii.*

We venture further west to find more close relatives of *P. drummondii,* who will help us in our quest to understand the species interactions that lead to evolution.

Illustration by Matt Huynh

Moving into the Texas Hill Country, cow-dotted pasture gives way to rolling hills laced with teeming cliffs and rushing creeks; never-ending networks of highways give way to winding county roads. Rather than crossing a lazy stream of trucks, we mount the ridges of bald cypress roots and wade through a slippery green current to our target population. These *Phlox* rest in the rocky outcrop between meadow and river, perhaps not so unlike the perimeter of pasture and road.

Even if the species in this family are similar enough to trick a butterfly, each has obvious particularities, personalities. Soon we come to know by sight or sense what kind of landscapes will be home to our study species, a kind of empathy for their wants and needs. "*Pilosa* wouldn't grow there," we say, with the intuition of familiarity; or, "*villosissima* would like this, it must be here."

Even if the species in this family are similar enough to trick a butterfly, each has obvious particularities, personalities.

At each site we come into intimate contact with *Phlox,* meeting them with careful and tender touch. We bend low to the earth, letting ourselves be engulfed by the grasses and grasshoppers, and run our hands through to comb apart the vegetation until an individual *Phlox* stands aside from the other stems. With our fingertips we test the calyxes for the taut, resistant flesh of fruit swollen from pollination; upon finding one, we push through the stem with a fingernail and tuck the fruit into a card envelope, where it will dry into a pod with three neatly packaged seeds to be planted in the greenhouses. We snip cuttings from the fresh vegetation of the perennial *Phlox,* who are no longer flowering, and wrap them neatly in paper towels moistened from our water bottles or the rain on the windshield.

We scrape at the ground with our hands to pull aside mats of grasses, clearing the way to collect soil with a trowel. We can see and feel in the grit stuck under our nails that the soil around *Phlox drummondii* is light and sandy, while *P. cuspidata* tends towards a muddier and darker substrate, and *P. pilosa* is usually found in the richer soil at the woodland edge; other times we collect what feels like more rock than soil, chunks of limestone around the roots of *P. roemeriana* and water-smoothed pebbles from the riverine ridges where *P. villosissima* grows. Later, results from the soil testing laboratory will confirm the differences in moisture, minerals, and nutrients that we feel on our skin.

The final day of work arrives, our bodies sweat-stained and sun-bruised, suitcases packed full with seeds and soil samples. Seen from the road, the lush green hills dissolve into markers of excess; the views moving across our windows like movie reels suddenly reflect a much different way of touching a landscape, a relationship not of empathy but of extraction. We pass a couple of dry creek beds, an irrigation reservoir that's been drained to blanched stone and rusty shipwrecks; a few highway minutes later, the green transforms into the sprinkler-fed lawns of new housing developments. By the time we reach the airport in Austin, we have only seeds, photos, and the feeling in our fingers to remember the rich landscapes that give us *Phlox*.

Back in the Weld Hill greenhouses, we nestle our newly collected *Phlox* seeds into soil, carefully mixed and moistened with the memory of the Texan substrate in our palms. As they grow, we are challenged to imagine ways of creating those conditions that their parents in the field so enjoyed. How could we reflect the shifting humidity of those open fields as the blazing sun goes down or a day of rain cuts through the drought? How do we compact the soil in a way that might mimic the tangled roots of fellow wildflowers, the footsteps of deer, the wheels of a farmer's mower? How do we, wielding sharp metal prongs, pollinate with the gentle touch of a butterfly's proboscis?

There are no perfect answers to these questions, only attempts at giving thought and care to the spaces where these plants have grown and thrived, the environments that make up their history—just as I would for any human companion. With an intimate understanding of the landscapes where they came from, I can better grow and learn from the *Phlox* right here at the Arboretum.

Katsura in Winter

By Michael S. Dosmann

I recently concluded an expedition to Japan with Miles Sax, and thoughts of gathering seeds are fresh in my mind. In Honshu's Yamanashi Prefecture, we happened upon one of the biggest *Cercidiphyllum japonicum* I'd ever seen. With a diameter of 5.5 feet and a height approaching 100 feet, it lorded over nearby trees with incredible majesty.

After returning to the Arboretum, I admired some of our oldest katsuras along Meadow Road. Far less stately but no less marvelous, accessions 882*A and *B also hail from Japan and date to 1878. They were collected by William Clark, who was in Japan to help establish the Sapporo Agricultural College (now Hokkaido University).

Katsuras are a treat in autumn, with golden-yellow, heart-shaped leaves and the aroma of burnt sugar tickling the nostrils. Winter is the best time to admire the multi-stemmed form, each bole sloughing silvery-gray bark in narrow rectangular sheets. Assuming you happen upon a female tree, you can also marvel at the small fruits attached to short-shoot spurs. Green in late summer, by autumn the curved follicles, nearly an inch long, have dried and split open to reveal the small, papery, winged seeds within. In midwinter, you can still see some seeds clutched inside. With each gust, a few spill out to be dispersed by wind and gravity. And if they land upon the snow, the seeds skitter away. It is a wonderful dispersal strategy, shedding seeds for weeks, even months, at a time, maximizing the chances of finding that perfect combination of moist fertile soil and light, a safe space not only to germinate with ease but to survive well into maturity.

Honestly, katsura seeds need little coaxing to germinate (a few weeks of cold, moist stratification does the trick), something I learned as a graduate student at Iowa State University. This was actually the first time I "sort-of" met the Meadow Road trees. I needed plants for experimentation and the Arnold, a ready source of germplasm, was a supplier. In September of 1996, large plastic bags of fruits from Accession 882*B (as well as 1150-67*A and 13008*A) showed up in the mail. Over that winter, I conducted a bunch of germination experiments, and by spring, I had a greenhouse crammed with hundreds of vibrant katsura seedlings.

Whenever I see those fruits in winter, I know of the countless seedling promises clasped within. I rarely resist the urge to tap the branches, shaking a few seeds out and into the breeze.

Michael S. Dosmann is the keeper of living collections at the Arnold Arboretum.

882*A in winter, snow framing every branch and spur. *Photograph by William (Ned) Friedman*

PERSONAL HISTORY

The Loss of an *Ailanthus*

By Benjamin Swett

I hadn't intended to visit that spot that day—not really, not consciously. But I ended up there, as I always seem to do on my walks through the city, at a place where something still lives that only I can see. The effect, in this case, was, as it always is, so entirely different from what I had half-expected to find when I turned the corner that coming up against it now, after 17 years, felt, as it always does, like slamming into something hard; as if a steel barrier had risen up from the street and I had banged into it. The impact registered as a constriction in my chest, a kind of claustrophobia, as I looked across and saw, above the tracks, instead of sky, the sky-reflecting facades of buildings; below the tracks, instead of the trunks of trees, the

Ailanthus altissima long has flourished in the urban in-between. In the midst of so much change and loss, is its era also passing? *All photographs by the author*

The *Ailanthus* in full leaf, with someone's personal effects neatly stacked at lower left, and TV antenna perched above along the future High Line ...

glass-fronted lobbies, apparently, of those same buildings; between, the tracks themselves almost hidden in scaffolding still up after years of construction. I kept thinking of what I remembered from before, the openness above and below the tracks; sky all around, unmitigated, unreflected, unblocked; views opening out toward the buildings of midtown on one side and the river and New Jersey on the other. Of course, I had not imagined, that day in 2002 when I first stood in this spot, that the elevated tracks would later become known as the High Line or that growing from the sidewalk and spreading under and around them, nearly hiding them, would no longer be the long green stems of an ugly, deformed, out-of-control *Ailanthus altissima*.

It happened that a friend from out of town was visiting, and we had made a plan to walk, earlier that day in 2019, down the High Line to check out the Whitney Museum at the south end. Nearly four years had passed since the Whitney had reopened at its new location on Gansevoort Street in the West Village and I still hadn't gone, though my friend had. I had avoided this part of town during the construction of Hudson Yards, the massive development (still incomplete) through which the High Line—the elevated railroad track turned popular park and walking path—ran. It was a warmish April day and, after meeting at the 34th Street steps of the High Line, we immediately started walking south and talking. We had not seen each other for some months—perhaps even for a couple of years—and though we had not started out in life as close friends (having met through our wives), over the years we had discovered interests in common, and lately something had sprung up between us that made us especially curious about, and eager to discuss, the other's point of view. Neither of us had walked the northern part of the High Line yet, nor had we seen Hudson Yards, which now rose in glassy splendor within the horseshoe curve of the tracks

... and the same site a few months later, with the tree, street-level vegetation, and all trace of habitation gone.

between 34th and 30th streets. Between discussing the new buildings and catching up with each other, our conversation jumped around at first, and it wasn't until we had come around the curve and walked into the plaza outside 30 Hudson Yards, beside the new arts center called The Shed, that I asked my friend how he was doing—because three months earlier he had almost died.

I asked him that question just there, I think, because rising before us in the middle of the plaza, surrounded on three sides by tall buildings, was the beehive-shaped sculpture known as The Vessel, an M. C. Escher-like configuration of staircases, in a sort of brushed bronze, that rose improbably and strangely above us, between the blue-gray, glassy skyscrapers on either side. I was wondering if my friend—a mountain climber and bicyclist for as long as I had known him—would be up to climbing to the top of this structure after his heart attack. (Access to the top of the structure was later severely restricted after a series of suicides.) As it turned out, he said, though he was still on some drugs, he actually felt better than he had before, because two of his arteries had been half-clogged, and now, with the stents, he found he could do more and didn't get so winded as before the heart attack. His recovery from what had been two surgeries had not been entirely unpleasant, he said, because he had been able to do a lot of reading and thinking, and figuring out what he wanted to do with the rest of his life. What he had learned, he went on, in response to a question of mine, was not to be afraid of death for himself, because if he had died—as he would have if the paramedics had not administered CPR when he was still minutes away from the hospital (so vigorously that they had broken one of his ribs) he would not have known what had happened. He would have just slipped away. It was not to himself that his death would have mattered, he said, but to his family and his friends. It's the other people who matter, he said, and the way he

The site of the missing *Ailanthus* now with a new building and the High Line under construction ...

said it, so straightforwardly, looking at me there in the cool shade of the buildings, I found myself thinking, not of his death, which had been averted, but of that of someone even closer to me, which had not. I responded that I thought I knew what he was talking about, from the perspective of having lost Rachel. The doctors had assured us that, given the nature of her accident, our daughter would not have known what had happened to her—in one instant she would have been herself, in the next gone. Yet her death, at 21, had affected literally hundreds of people aside from us, her parents and brothers—and for us the repercussions were still being felt nine years later. My friend had known my daughter, so I felt comfortable saying this to him.

We continued talking like this for some minutes, standing in the shade of the tall buildings as people rushed past with cameras and strollers and guidebooks, and then my friend, who was wearing only a tweed jacket and a scarf, said, perhaps we should continue on, we'll catch a chill standing here in this breeze. And it was only later, after the afternoon had ended and I was on the subway home, that I realized that we had forgotten all about climbing The Vessel, so absorbed had we been in talking; and I wondered if my friend, too, had realized, later, that we had not done what we had in some way been contemplating doing—the thing that one was expected to do at this point—but had, instead, turned away and continued south along the High Line. As I sat there in the strangely empty subway car hurtling toward Times Square, I realized that as we had turned away and continued south, we had passed directly over the place, on the north side of 30th Street, just east of 11th Avenue, where the *Ailanthus* had grown. And at that moment I had not given it a moment's thought.

Thinking back on that walk, and how it ended later that afternoon, in that nearly empty subway car, I ask myself now, what is it about the loss of that *Ailanthus*

... and in the most recent view, with the High Line open and a new street tree.

that matters so much to me? It is not as if a tree is a person (just to get that out of the way). A tree is a large woody plant, and there are many of them in New York City—around seven million, according to recent estimates. What is it about the loss of this one that is so important to me that I would still be sitting here, at my desk in my apartment, four years later, puzzling about it, as I have been doing ever since that day? I am reminded, as I write these words, of a name someone once gave me that I long resisted, but that I have finally come to accept, and that gives, perhaps, an opening to some of the complicated feelings behind my confusion. It was a journalist who gave me the name: "tree person." Being a tree person, in the eyes of this journalist, was a good thing; he identified as one himself, and his article, recounting a lovely morning we had spent driving around the parks and streets of New York City looking at trees, had seemed to confirm his belief in the nobility of this calling.

By implication of course, as I think most people would agree, a tree person is not the same as a tree hugger. All tree huggers are tree people, but not the other way around. Tree people can be loggers, foresters, naturalists, tree guides, dendrochronologists, or, like me, photographers. They can work for electrical utilities as well as for botanical gardens. "Tree hugger" is, in its current most frequent use, a pejorative term flung around by those with a financial interest in trees to cast a negative light on those who wish to protect them. It is a damning euphemism, like "welfare mother" or "snowflake": a political term, in other words. And like those other political terms it has crept into the national vocabulary and done its work of poisoning attitudes and narrowing beliefs, so that now it goes beyond trees to stand for someone who opposes progress and puts the needs of the natural world above those of the human. Many people, of course, are happy to embrace the term "tree hugger," because they are not afraid to be seen to have an emotional attachment to trees. In fact, they

want to be seen to have one. The term is employed in some cases even—usually by politicians of one kind or another—as a public relations tool to temper otherwise hard-edged reputations. In these cases the term is habitually preceded by a "but also," as in, "a realist but also a tree-hugger" (as if to be a tree-hugger is to be someone who lives in a world of fantasy). "Tree person," though, has none of those connotations, either positive or negative or PR-connected. It is neutral, cool, factual, capable of new iterations and interpretations.

Still, for a long time, despite its neutrality, I resisted identifying even as a "tree person." There seemed something narrowing, limiting, in allying oneself so closely with a single cause. After all, wasn't I also a father-person, a husband-person, a photographer-person, a writer-person; someone involved with archaeology, technology, books, birds? Couldn't I be a social-justice person, a world-peace person, a healthcare-for-all person? Why must I be identified with something so nice and seemingly innocuous as trees? Plus, in some ways, as I was only too well aware, my attitude toward trees was far from innocent. I like splitting firewood and burning it in fireplaces—preferably several fireplaces at once. I enjoy using my chainsaw—the roar of the engine, the acrid smell of the exhaust mingling with the sweetness of the sawdust as it comes flying out, the accurate placement of cuts so that the tree falls just as you planned it; the thud of the long, heavy trunk on the ground, the branches crackling around it. I am too hypocritical, I felt, to merit such an honest title, at the same time as I am too ambivalent to wish to be limited by it. And although I felt that caring for trees did, by its very nature if properly pursued, also require caring for one's neighbors, and advocating for policies that would be for the benefit of people as well as of woody plants, the difficulty of establishing such a connection in a way that others could understand and accept eluded me.

It is with much the same bafflement that I sit brooding about the *Ailanthus,* a tree that even the most die-hard tree-huggers love to hate. For most people, the *Ailanthus,* or tree-of-heaven as it is also called, is a weed tree, an invasive species that takes root and grows quickly in places that people aren't looking after: empty lots, forgotten cul-de-sacs, forest openings where power lines have been put up. Native to China, it was first brought to Philadelphia, according to E. S. Barnard in his *New York City Trees: a Field Guide to the Metropolitan Area,* by a horticulturist in 1784 as part of the complex global trade in exotic botanical specimens that reached a high point during the 18th century. The tree now grows wild, Barnard tells us, "from Canada to Argentina." It is so adaptable, so quick to take hold, that it can flourish in the accumulated dust in the corners of abandoned balconies or in the darkness under sidewalk grates—or, in the case of the specimen that I saw and photographed one day in 2002—in a disused space under an elevated train track.

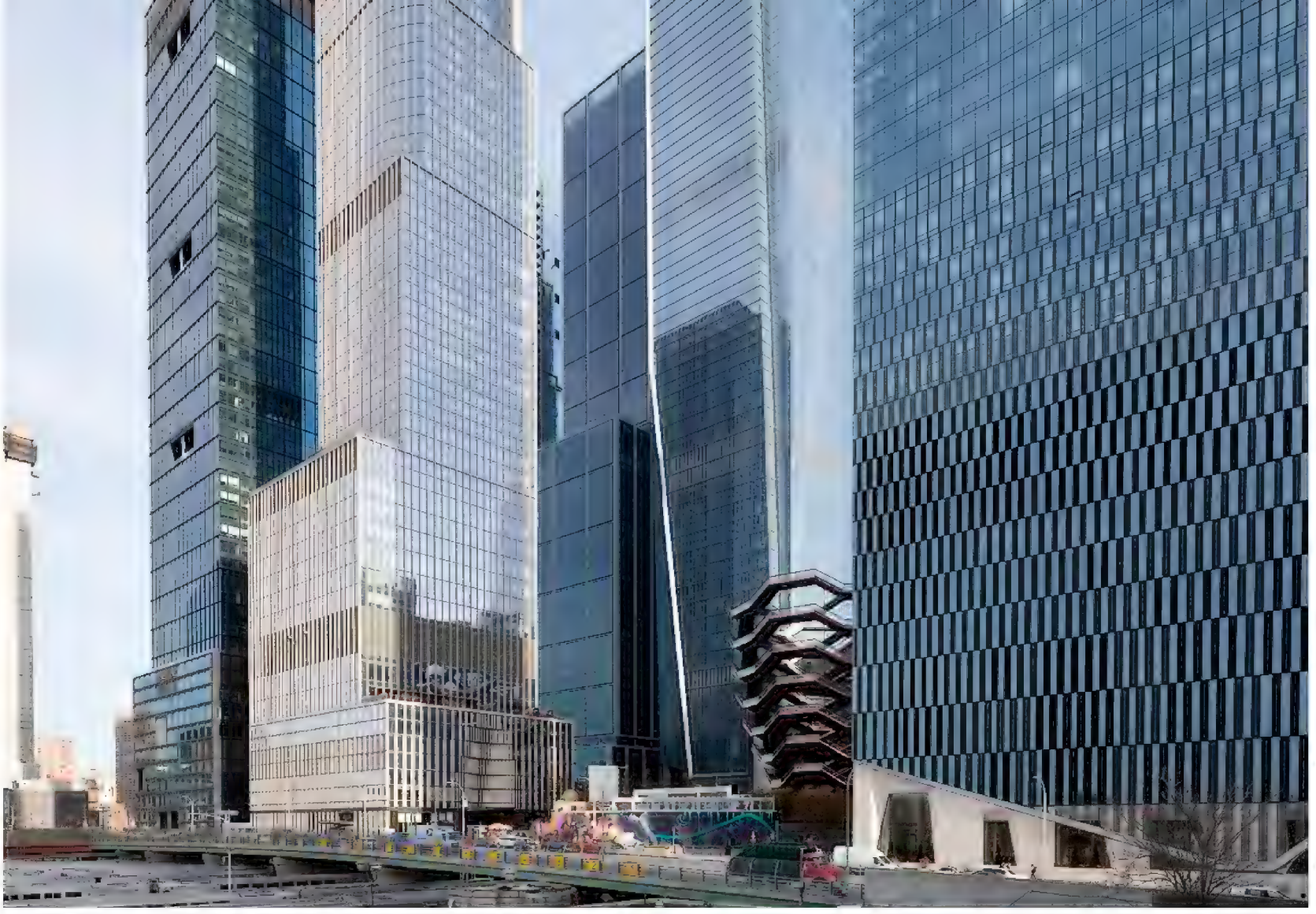
The *Ailanthus* is not a tree that many New Yorkers—even tree people—try to defend, not only because its voracious appetite for life tends to allow it to push out supposedly gentler native species, but because it is associated with a city out of control. In the book in which the species perhaps most famously appeared, Betty Smith's 1943 novel *A Tree Grows in Brooklyn,* the tree was already treated as a symbol of some kind of decline, a lost order, invasion even (in this case by immigrants). Today it is one that many New Yorkers associate with the 1970s, when subways were covered in graffiti, Central Park had lost most of its grass, blocks of the South Bronx had been reduced to rubble, 42nd Street was a gauntlet of strip parlors and triple-X movie theaters, and the city was defaulting on its loans. The city's financial troubles steepened a decline in staffing at the Parks Department that had begun in the 1960s. Without sufficient foresters to maintain even Central Park's trees, let alone those of Prospect or Pelham Bay or any of the city's other large parks—and perhaps without the will to do so—the agency let nature go a bit. That was when the *Ailanthus,* stronger and quicker than its competitors, began thrusting its spiky leaves from cracks and crevices all over town. I sometimes wonder if it isn't the threat of a return to the impecunious, *Ailanthus*-filled days of the 1970s that has continued to justify, in the minds of so many, the growth-oriented building frenzy that still dominates political talk in the city today.

The specimen that I photographed under the tracks in 2002—and included in my book in 2013, after the tree had been removed and the tracks renamed "The High Line"—had somehow managed to keep growing for some years when I first came upon it, pushing up through a pile of old tires behind a rusty fence. An orange steam pipe towered out of a brick structure beside it. A cage covered a rusty air-conditioner in the window of the structure, which had perhaps once housed an office. Graffiti covered the walls and weeds sprang from the cracks of this

A TV antenna suggested that somebody watched things under the tree. That somebody, in other words, had electricity there. That somebody, quite possibly, found the tree a congenial place to live.

abandoned, under-the-tracks office. Somebody had recently stashed some personal items out front—a milk crate full of papers, a suitcase, a rectangular object covered in a dark sheet and a tubular one in brown paper. A jagged opening in the fence suggested that somebody climbed through and vanished under the tree on a regular basis. A TV antenna attached to the rail of the elevated tracks above suggested that somebody watched things under the tree. That somebody, in other words, had electricity there. That somebody, quite possibly, found the tree a congenial place to live.

The distance from the 34th Street subway station to the new Whitney museum is a little more than a mile, but because of the crowds trying to make their way up and down the narrow boardwalk on this spring morning, stopping at inconvenient points to photograph each other with New Jersey, or the Empire State Building, or the Freedom Tower, or all of midtown, or just some random building, in the background, it took nearly an hour for my friend and me, after finishing our conversation outside The Shed, to get to the museum. We were not in any particular hurry, and, exploring our mutual interest in cities and gardens, we ourselves kept stopping to observe a particular group of shrubs artfully angled out from a curve in the railroad tracks that remained, now surrounded by fertile topsoil, in their original places under and alongside the boardwalk, or to notice the backhoes excavating in a triangle beneath us, as if to create the basement for a pocket building in the only unclaimed bit of land along the raised park. It was then, as we ambled south, that I finally remembered "my" *Ailanthus,* and started telling my friend about the time, 17 years before, that I had found and photographed it, and about how, eight months after taking my picture, I had gone back to photograph it again in a different light and found that it was gone—along with the milk crate, the suitcase, the other objects, and the TV antenna on the railing above. I had taken a picture anyway, I told my friend, of the empty spot, but, as always happens when a tree has been removed, the location had lost its center and my photograph, when I looked at it on the contact sheet a few days later, seemed wrong. The office and the smokestack looked lost without the tree between them. Happening to speak with the owner of a woodworking shop in the building across the street, I learned that the tree had been cut down a month or so before. When I asked why, the woodworker—who still had sawdust on his apron and in his hair, and



The Vessel peering out from behind 35 Hudson Yards, surrounded by the new towers crowding the development.

who spoke with an Italian accent, said, with a flip of his hand that seemed to indicate that this was the sort of thing that usually happened, and he really hadn't had the time to look into it, and was only speculating—that he thought the tree had been cut down to clean up the block. And so, I told my friend, as we pushed our way along the High Line, constantly interrupted by people stopping in our path, that it was not for another nine years—well after the High Line had begun opening in sections, and the little building containing the woodworking shop had been knocked down and replaced by a corner of the tall glassy building that stands there now, and I was doing research for the book I published in 2013, *New York City of Trees*—that I exchanged some emails with some of the staff of the High Line and learned the real story of the *Ailanthus*. One of the gardeners, in particular, told me that he remembered the tree very well, that it was not a single tree but a grove of individual trees massed together. The trees had been removed, he said, because of their classification as an invasive exotic species, and the landscaping plan for the High Line called only for native plantings. But what, I asked, about the idea of recreating the look of the elevated tracks during their years of abandonment? One of the main plants growing along it, I reminded him (as I had seen in photographs of the unrenovated High Line by the photographer Joel Sternfeld) had been that very invasive exotic species. To this e-mail another staff member of the High Line, Danya Sherman, responded. Reproducing the effect of *Ailanthus* without actually planting it, she wrote, had been accomplished by planting sumac, a native species whose leaves look very much like those of the *Ailanthus*. And so, I said now to my friend as we continued south along the High Line at our slow pace, those sumac you see over there are supposed to remind you of the missing *Ailanthus*. I said this with a certain irony, because the *Ailanthus* I remembered was on such an entirely different scale than the pruned little sumacs before us, whose prim delicacy only seemed to accentuate the voracious grandeur of the tree I remembered. Of course my friend could not see the contrast, but I could tell that he caught the irony. My comment led, at any rate, to the start of another, related conversation, which brought us to the bottom of the High Line and into the Whitney; and as we were both by this point quite hungry, we quickly agreed to go straight up to the restaurant on the eigth floor, where there was a balcony, my friend remembered, where we could eat and continue talking.

Self-identification and public identification are two different things, and rarely do they happen simultaneously. In my case, self-identification as a tree person—someone who admitted to himself that he did notice trees, that he looked for them, and that he even felt emotions about them—came one day in 1996 at an exhbibit—strangely enough at the "old" Whitney Museum at 74th Street and Madison Avenue—called ***NYNY City of Ambition.*** Taking as her leading idea that by the beginning of the twentieth century, for American artists, "the splendor of the skyscraper had superseded nature" as a subject for art, the curator of the blockbuster show, Elisabeth Sussman, had culled from the Whitney's vast collection of art from that century, and from the hoards of a few private collectors, the paintings, sculptures, and photographs of artists who, as she wrote in the catalogue, had "plucked from the city's visual cacophony those singular images that collectively describe urban life." The eponymous central image of the exhibit was Alfred Steiglitz's smoky, dark image of buildings pushing into a gloomy sky over a river where tugboats lurked, "a skyline," Sussman wrote, "of smoke-spurting minarets, a city of power, wealth, and luxury." I remember being curious, as I walked through the massive exhibit, which, as I recall, filled all five floors of the building, to see if any of the images chosen by the curator would correspond to my own image of the city. But not only did I fail to find such an angle, but the city represented by the vast array of pictures and objects turned out, disappointingly, to be a quite narrow and obvious (if popular) view of New York—an idea that represented a city perhaps parallel to the one I thought I lived in, but incomplete and barren, lacking the openness and greenness, the smells and textures and sounds, that I knew also to be there; and though as I walked through the galleries I noted how the curator had certainly done a thorough job finding sources to support her argument, I felt quite sure—though I could not name them and could only speculate about their existence—that she must deliberately have passed over quite a few other works whose inclusion in the show would have complicated her argument and presented a more nuanced and, to me at least, believable view of New York.

At the time I went to that show at the Whitney I had been working for eight years for the New York City Department of Parks & Recreation. I worked at the Arsenal, the agency's headquarters at 64th Street and 5th Avenue in Central Park, and because of that building's central position in a citywide network of borough offices, district headquarters, parks, playgrounds, and recreation centers, it had, in relation to the rest of the city, somewhat the connection of a major international airport to the world. Just as, through the concourses of the airport, as you sit waiting for a flight, you can watch people from all over the planet, in their particular outfits, speaking their different languages, pass by, so as you sat in the Arsenal Gallery, writing, say, a grant proposal with a co-worker from Queens, you could watch the commissioner from Staten Island walk by in his jacket and tie alongside a park ranger from the Bronx in her green uniform and cowboy hat, and a recreation chief from Brooklyn, in a button-down shirt with the top two buttons undone, attending a meeting of his counterparts from the other boroughs, also in button-down shirts, but of different colors, with either both or just one of the top buttons undone, while a member of a tree pruning crew, with sawdust still clinging to her chaps, stopped in to drop off the keys to a vehicle requiring maintenance. Adding to this feeling of centrality in an interconnected universe of parks was the fact that it was from the Arsenal that I would often drive, in a bright green truck or SUV, to visit one of the thousands of properties under the jurisdiction of the agency spread around every corner of the city.

In those days (and it is not much different today) when an image of the city formed in my mind, I saw it, like those three-dimensional plans of Paris with the Eiffel Tower at their center, or of Rome with the Tiber as a kind of snaky organizing principle in the middle, spread beneath me as if from a tower high over the Arsenal; and this map, as it appeared in my mind, was a spotty three-colored arrangement of blue, gray, and green. Because I had studied the histories of some of the green parts, and knew that many of the trees of the city were older than the buildings that had sprung up around them, and how even in recent years highway construction had divided neighborhoods and open spaces in arbitrary ways having nothing to do with topography or ethnography, it was the green and the blue parts that seemed to me to be the real, authentic sectors of the plan, and the gray, which constituted streets and buildings and bridges and airports, and the vast parking lots of the superstores that had begun springing up here and there, as unreal, even ephemeral additions to a place with a much older natural structure.

When I found myself at that Whitney exhibit in 1996, it was as if somebody were holding up a

facsimile of that bird's-eye map, only with the green and the blue parts erased. Everything in this view of the city—the view presented by the exhibit—was gray. Landscapes consisted of buildings, rows and layers of tenements, skyscrapers—sometimes still in the process of construction—rearing up to the sky, rooftops stretching back to ever-higher rooftops, abstractions of the street grid, groupings of buildings under construction. Waterways were just another shade of gray. Two Georgia O'Keeffes, nominally of the East River, overwhelmed that watercourse in a smoky grid of rooftops and black smokestacks. Howard Cook's menacing woodcut *Skyscraper* and his etching *Times Square Sector* presented the city as a geometric puzzle in black-and-white, as did Berenice Abbott's photograph of buildings at night, *The Night View,* and—especially—Thurman Rotan's photomontage of a completed Rockefeller Center, *Skyscrapers,* in which identical buildings climbed back from each other to the sky. Edward Hopper's *Apartment Houses, East River* and *Queensboro Bridge* allowed a few trees to slip in beneath monolithic architectural forms, but even here nature felt like background, like the unfinished parts of a work-in-progress. Aside from Berenice Abbott's, the other photographs in the show depicted New York as a place of success or degrading failure. WeeGee's stark nocturnal catalogues of murder victims, Diane Arbus's renditions of outcasts and freaks, and Paul Strand's depictions of anonymous office workers passing into shadowed alleys showed the uncomfortable side-effects of a celebration of sameness and uniformity that the construction of ever-taller buildings seemed to entail. This was the flip side, the show seemed to be saying, of what the director of the Whitney at that time, David A. Ross, called, in his Foreward to the exhibition catalogue, "ambition as an idealized source of energy and inspiration." As the show seemed to have it, one person's energy and inspiration is another person's downfall. Like Frank Sinatra singing "New York, New York" (which I almost seem to remember piped through the Whitney as I walked from gallery to gallery), the exhibition celebrated a view of New York as a place where the purpose of life was to become "king of the hill, top of the heap." "If I can make it there," this organization of pictures seemed to be saying, over and over, "I'll make it anywhere." Or you won't. New York in this view was a sort of "making it" machine, which each person entered for the sole purpose of striving to outdo every other person, and came out either made, partially made, or unmade. The realization that New York, for me, was *not* such a process or function, *not* a place with such preordained outcomes, but something else—a place of memory and experience and discovery, a place of trees that had been growing for longer than I had been around, a place to live, a place to call home—gave me, as I walked through that show at the old Whitney, a feeling of claustrophobia not very different from what I experienced this afternoon 23 years later when I gazed on the place where the *Ailanthus* had grown.

It was shortly after that museum visit, passing through the South Bronx on one of my drives from the Arsenal, that I saw, out of the corner of my eye, in a playground, a park house reflected in a large puddle. Something about the combination drew me to a stop. I pulled the truck into the playground, got out, and stared at the reflection, which presented, I decided, the longer I looked at it, some of the symmetry and grace of the Taj Mahal as it reflects in its pools on a sunny morning in Agra. The day was cloudy and the park house was in poor condition and locked. A couple of garbage bags bulged under the window, waiting for someone to take them away. Instead of the carefully tended short conifers, mimicking minarets, that line the reflecting pools in front of the Taj, untended elms or lindens bunched in from either side of the park house, whose roof was missing some of its slates. As I took out my camera to photograph the building in the puddle I felt something in me turn. The picture, I thought, as I clicked the shutter, was not the sort that would have appeared in "City of Ambition." It had nothing to do with massive development projects. Nor did it document the victims of that ambition that David Ross, the Whitney director, had celebrated in his Forward as "the primal force that ... defines New York."

It was a picture, this one, that showed a city where rain fell and puddles formed on concrete, transforming a barren stretch of gray into a reflecting pool; a city where, as if in counterpoint to the ever-taller buildings, the city had erected these squat, ugly, but strong and functional park houses. Drab and institutional, smelling of the decades of ammonia that workers with mops had spread across their floors, these structures were still, more than half a century after their construction, the only unchanging pieces of architecture in most playgrounds, containing such useful amenities as toilets, sinks, closets for maintenance equipment, and, in many cases, a desk for a park manager. Identical in appearance, mostly built in the 1930s and 1940s when depression-era public

"A city where rain fell and puddles formed on concrete"—a city of untended trees, like those crowding this park house reflected in pooling water.

works programs had created a park building boom never seen before or since, the buildings were, and still are, probably, the most common architectural element to be seen around the five boroughs of New York City, linking parents and toddlers in Queens to parents and toddlers in Brooklyn and Staten Island, and giving everyone a sense of connection to an organized system designed to promote the health and physical well-being of citizens. This one was beginning to fall apart, of course, as things do even in the City of Ambition. Somebody might or might not find a place in their budget to renovate it. But I thought, as I stood there, about how this particular park house, made momentarily grand by its doubling in the puddle, may have been built in what had once been an open space, a field or a pasture or some other unpeopled plot where the city had been able to claim ownership and construct a playground, and how this plot had been part of a stretch of land that had once been all trees, back before any of these buildings had been erected, and that the trees growing here now, these elms, were almost an afterthought compared to the truly majestic ones that had once grown here, the chestnuts and oaks and white pines and tuliptrees and sycamores that had cast this stretch of land into deep shade in the days before Europeans like me had arrived with our ambition and our guns. And as I stood there I felt the turning within me come fully around, and I found myself smiling, which is a strange thing to do when standing in a flooded playground in the Bronx at 10 am of a cloudy morning, because I suddenly knew what I would like to do next in my life, how to express what it was I was seeing in this park house in the puddle. I would make a book, with photographs and text, that would be an answer to the *City of Ambition*. I would call it *City of Trees*.

The subject my friend and I were talking about after looking at the sumacs on the High Line, and which we resumed over sandwiches on the eighth floor terrace of the Whitney, was gardens. One of the main passions of his life is a large, entirely organic vegetable garden and orchard at his house in the Rhone Valley where he lives with his family in France. I have always had a garden myself, but mine is a slap-dash, makeshift patch of raised beds and weeds inside a flimsy wire enclosure behind our house upstate, nothing like the verdant couple of acres where my friend's abundant, succulent crops seem to shoot up toward the sun more of their own accord than from any effort on his part. Prompted, at any rate I think, by the irony, different from the one I had been enjoying

about the sumac, of the *Ailanthus* being imported to the U.S. at the end of the eighteenth century as a rare and valuable exotic only to become, by the end of the twentieth, what most people consider an invasive weed tree, my friend began talking of other ironies and paradoxes embedded in gardens, where the most ordinary plants turn out to have fraught histories of colonialism and capitalist trade, and where what most people consider weeds and pests can be looked at in a different way and used to promote the fertility and productivity of the soil. He began explaining how in his garden in France he had started a program, not entirely successful yet in some ways, but which he was excited about and was going to keep experimenting with, in which he worked with the weeds and pests, not to eliminate them but to try to encourage them, as he put it, to help him out. What it really gets down to, he said, is the amount of digging you choose to do. Different organisms, he said—and he began listing various bacteria, fungi, and archaea—live at different levels in the soil. Turning over more than the top two inches of earth in your garden reduces their number when you actually want, he said, to encourage as many as possible. Left to themselves, he explained, those microscopic creatures and their predators further up the food chain keep the soil loose and alive.

We were still on the High Line then, and I found myself wondering, as we passed the neat shrubs and small trees and grasses that the gardeners had planted in cocoa-shell mulch, what kinds of organisms might live under that mulch and whether the High Line staff followed a similar no-dig approach in maintaining them. Thinking then of my own garden, I asked my friend whether not turning over the soil—which I did religiously every year—wouldn't also encourage weeds, and he immediately came back at me about how questionable the very word weed is, and about how some of the so-called weeds we talk about are actually helpful plants that could help fix the pH balance of soils and encourage the very types of microorganisms he'd been talking about. For the past hundred and fifty years, he went on, as horticulture has become more commercialized and agriculture more industrialized, the regular use of weed-killers, insecticides, and non-organic fertilizers has tended to sterilize the soils where those microorganisms could otherwise thrive. The position of humans in relation to nature has in too many ways become one of dominance and oppression rather than one of cooperation, and this is as true, my friend said, in gardens as

Every tree in a city, struggling for space in its own circumstances, is different, and every one is a living mirror of the place where it grows.

it is in agribusinesses and international relations. We sat on this for awhile (we were on the terrace of the Whitney now, eating our sandwiches) and then my friend continued, but a different paradigm does seem possible, at least with gardens, in which a garden is made in cooperation with nature rather than in opposition to it, and he started to describe in more detail his own efforts, often unsuccessful, to welcome every form of life—even slugs, which he was currently battling—into his garden, and make the garden as much about all those other ways of being (by not-digging, by mulching, and by growing plants especially for them) as it was about the harvestable crops that were his garden's apparent purpose. He was just beginning to tell me more about this inspiring and, it seemed to me, quixotic program when an approaching helicopter that we had been vaguely watching began hovering over the museum balcony where we sat, so that my friend had to start shouting to make himself heard, and we had no choice but to lapse into silence for a while, as I thought of the hundreds, perhaps thousands, of people in the museum, along the High Line, and along Washington Street with its cafes and restaurants below having to shout at each other or even cover their ears and fall back into stupefaction because of the painfully loud machine overhead. Did

the people inside the helicopter have any idea how many of us they were affecting with their painfully loud sound? Did they care? Eventually the helicopter veered off, but our conversation, darkened perhaps by the interruption, reverted to that earlier topic of human dominance and oppression and the ways they manifest themselves in the landscape and in life and stayed there for a while before itself veering off, as conversations will, in another direction entirely.

It was not until some time later, after we had gone to an exhibit two floors down of art based on computer systems and algorithms, and had gone further downstairs and out to the front of the museum, and my friend, explaining that he had to go back uptown to his father-in-law's to say goodbye to his wife before he flew back to France in the morning, had said goodbye and gotten into a taxi and sped off—it was not until I suddenly found myself alone in front of the museum that something else my friend had said struck me. I had pointed out that in many ways his ideas about people's relationship to gardens could also pertain to their relationship to trees, especially to trees in a city, and I began listing the many ways that mature trees, left alone to grow wherever they are at their own pace, make cities better places to live, and the many circumstances that too often lead to their premature removal. That was when my friend said, the efforts of a few people to fashion the city according to their own desires, and usually for their own profit, always come into conflict with the need of the larger community for those things you list.

Remembering those simple, straightforward words as I stood on the front steps I found myself thinking again of the *Ailanthus* I had photographed in 2002, and of something else trees do in a city, which I had not thought to include on my list for my friend, that make them antithetical to the kinds of dominance and control we had been talking about. Only I, and perhaps a few others such as the older gardeners on the High Line (if any were left), remembered the ugly tree, and perhaps only I cared enough about it to keep thinking about it. In the history of changes in the city, trees like that—chance, opportunistic weed trees whose every leaf breathes insurrection against the urban grid—had always been in the weakest position. Not even the Parks Department, which oversaw street trees and required a permit from anyone wanting to cut one down, would have questioned the removal of that one. Yet what trees like that *Ailanthus* represented was a quality that I could only think of as the local. No matter what its species, a tree can only grow in one place, and it can only grow as the restrictions of that place allow. It looks for space and air, light and water, and takes them as it finds them. Every tree in a city, struggling for space in its own circumstances, is different, and every one is a living mirror of the place where it grows. It defines and particularizes the place, and is part of what makes the place local. People need the local, because it defines and particularizes them. Without it they are like the saddest cases in that exhibit I had seen so many years before at the old Whitney, the lost souls in Edward Tooker's *The Subway* (1950), who wander an endless labyrinth of corridors and staircases and gates and turnstiles, never getting anywhere and always worried. As I stood there, somewhat irresolutely, on the front steps of the Whitney, feeling suddenly bereft in the absence of my friend and besieged by this depressing image from the long-ago exhibit, my mind turned back to Hudson Yards, where he and I had stood talking just a couple of hours before.

Perhaps I am too much a creature of the 1970s, a product of apartments where the spiky leaves of *Ailanthus* rose green and sparrow-filled outside my window, but those massive towers with their sky-reflecting glass and their wind and their blankness are not places I can imagine living. As I saw them then in my mind's eye, so tall and sleekly designed, the buildings looked as if they had been created as part of the cardboard set of a science fiction movie, or the fantastic structures of rides at an amusement park: buildings whose forms could only be appreciated from a distance. Thinking of them, and of that ugly, long-gone tree that, among so much else, they had replaced, I decided (if only to top off my misery) to walk back uptown and pay a visit to the spot where the tree had grown. I started walking out Gansevoort Street from the front of the museum, but, perhaps because of the beer I had had at lunch, or because I hadn't yet adjusted to the solitude after the sudden removal of my friend, my mind was elsewhere, and I started walking south on Washington Street. It was not until I had covered a full block, and looked up to see the Freedom Tower gleaming in the mid-afternoon sun far ahead of me, that I realized my mistake and turned around and retraced my steps north.

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TREES OF LIFE

The White Oak Tree at McLean: A Case of Recovery

by Rachel May

Those who have learned to listen to trees no longer want to be a tree. They do not yearn to be anything but what they are. That is home. And that is happiness. —Hermann Hesse

Driving up the hill to enter campus, the road gently arcing to the left, it's always the trees that woo me: first, an apple orchard to the left, then, beside the first of the brick Gothic and Tudor buildings that lend this place its stateliness (or ghostliness, depending on who you ask), a row of massive pines standing sentinel, shading the small groups of patients who sometimes take advantage of the lawn. At the top of the hill, a spot Frederick Law Olmsted chose in 1872 for its expansive views of Boston and the old trees that stood here back then, I park my car under the shade of quaking aspens and

Above: Women under the trees at McLean's original site in Somerville, 1875, photograph by Edwin N. Peabody. *All images courtesy of McLean Hospital Archives*

red maples in a lot blowing with cottonwood seeds—duckling-soft in my palms—and march towards the Admissions building, not to check myself in, this time, but to spend part of my sabbatical year researching in their archives.[1] It's taken more than two years to get access. I cannot wait. And at the same time, I'm anxious to have returned to a site where I was once so sick.

In New England, McLean is often thought of as a hospital for the elite, once housing literary giants like Robert Lowell, Sylvia Plath, Anne Sexton, musicians Ray Charles and James Taylor, and, more recently, Selena Gomez, and NFL star Brandon Marshall. Admittedly, when it was time for me to go (my stay was entirely covered by my free Massachusetts health insurance), I told myself this was the best place in the world for the treatment of Obsessive Compulsive Disorder, and that its reputation and legacy meant I'd get my greatest shot at overcoming the disorder. All of that turned out to be true. I have been very lucky. My treatment team was incredibly skilled and experienced. They saved me. Or, as they say, they helped me save myself.

But today, looking back, I think that it was also this place—its beautiful landscape, the old trees, feeling apart from the world in a wind-blown sanctuary—that played a role in my healing, too, and that maybe the hospital's nineteenth century founders deserved some credit as well. Twelve years later, when I return to campus, my first impulse is to say hello to my old friend, my favorite oak tree, which has stood rooted in the bowl since the hospital's founding. I know because all year, I've been obsessively tracing it back in time, scrutinizing old photos and lantern slides to track its growth since 1895.

McLean's trees might seem like a trivial piece of this centuries-old institution's history. But my interest is rooted (pun intended) in the hospital's most fundamental principles, which have been carried forth into the present day: the Moral Cure, a humane approach to mental healthcare that's grounded in treating patients with kindness and helping them to heal with architecture, the environment, and access to the work and hobbies that fuel their bodies, minds, and spirits.[2] Today, in the wake of the ongoing pandemic and rising anxiety and depression, we espouse the benefits of "tree bathing" and spending time outdoors, away from our tech and devices.[3] McLean's campus offers a living map of the history of psychiatry's value of the natural world in patient care.

I've never been good at memorizing names and classification systems, but lately, I've been trying to know natural places more intimately by learning to differentiate between species. It started five years ago with a walk in Michigan under the trees, when I asked a friend to help me. I was embarrassed that I didn't even know which were maples and oaks. A Canadian scientist, she said to think of the Canadian flag, maple syrup: a stouter leaf. Oaks, on the other hand, she said, are shaped like our hands. She stretched her fingers across a leaf. I did the same, my fingertips reaching to the edges of a leaf's lobes, mimics of each other (we both have large palms and long, thin fingers). Robin Wall Kimmerer writes about the importance of knowing species' names, even if they're only the names we make for them, distinguishing one from another.[4]

When I was a patient at McLean, I didn't know the type of tree I'd been sitting under for weeks. I only knew it brought me comfort. The 1960s patient map I'm given over a decade later tells me it's a white oak, and when I go back now, I marvel at its leaves that reach and flutter like thousands of hands in the air.

Like the naming of species and taxonomies, diagnosis is a linguistic process based on defining characteristics. The year before I went to McLean, I'd found myself in the Alice-in-Wonderland state of being thrust into a new world because my body and past had changed with sudden knowledge. At thirty-two, I told someone my symptoms, and she gave me new words, a diagnosis: OCD, Obsessive-Compulsive Disorder. She might as well have said, Here is a different story of your life.

From the time I was eight or nine, when the intrusive thoughts began to torment me, I thought I was secretly a monster, and that one day, I'd go insane and be locked up forever. When I finally learned that I didn't have a case of secret sociopathology but a treatable anxiety disorder, I was floored—both relieved and disillusioned: I'd spent twenty-two years avoiding much of what I wanted simply because of what I now know was just OCD? How could I not have known? How could I have wasted so much time? And now that I was so sick, how on earth was I going to get better?

My life unspooled behind me in a shape I couldn't narrativize. I lost my ability to write. Isolated in my apartment, I made fabric pictures, intuitively trying to make stories out of my overwhelming experiences and feelings.

McLean's Belmont campus, view from Administration Building undated, in a photograph by A.H. Folsom.

I spent a year and a half in darkness, lost, trying to do OCD treatment but feeling like it was so deeply rooted throughout my body, it was futile. Attack it in one place, it grew in another. Working hard to stay alive, I spent time outside, under the trees with my dog, and I went to look at art. Having planned my own death one winter day, I found myself at the Depressions Clinic, a day program at McLean. Finally, here I was in the sort of place I'd always believed I'd end up: the mental hospital, as I thought of it, an image that came from 1970s pictures of neglected people languishing in over-crowded halls. I had no idea that a place like McLean existed. I found not anguish but high-quality care, the halls filled with people like me, working to heal, and even, often, laughing. I survived that winter, and in May, I checked into the OCD Institute at McLean. This, I knew, was my chance. And it was terrifying: now, I'd have to face down every single fear.

On my return to McLean's archives last year, I dove into researching the history of the hospital, combing history books for accounts of its development, seeking the sources of its impact on me. In 1811, the Massachusetts General Hospital Trustees voted to open McLean Asylum for the Insane in Somerville, at the Barrell Mansion, a site selected for its bucolic attributes: fields that sloped gently towards Millers River, tall trees, and beautifully manicured gardens.[5] Patients could be ferried between the hospitals by boat, food shipped from the farm at McLean to Mass General. According to contemporary historians, by the 1870s, McLean was forced to find a new location because it was being overrun by the expanding railroad system in Somerville. A few months later, Evelyn Battinelli, Executive Director of the Somerville Museum, corrects me.

"It wasn't just the railroads," she says. "The bigger problem was the pollution from the quickly growing meatpacking plants that were built around the asylum," she says. "The plants were disposing of carcasses in Miller's River, and it got so bad, McLean had to move."

I go back to newspaper articles and accounts from the 1870s, and read that factory managers believed the tide would carry the animal remains out of the estuary. They were wrong. The river was soon overrun, in what one resident described as a "fetid" mess.[6]

Immigrants who lived in the neighborhood to work in the factories and plants were made to endure the stench and unsanitary waters until the town was mandated by the state government to fill the river and create an underground container for the carcasses—the first U.S. environmental law.[7]

The Barrell Mansion and Cobble Hill were levelled: trees razed, the hill used to fill in the river, patients transported in 1895 under the cover of a series of carriage rides to the Belmont site. Relocation complete. "One by one," Reverend Edward G. Porter writes in the 1896 Massachusetts Historical Society Proceedings, "the natural beauties of our metropolis are giving way to the imperious demands of our commercial growth ... this well-known eminence just over the river must not only surrender its half-dozen large and well-built structures of brick and stone, its stately elms and its terraced gardens and orchards, but the hill itself is at once to be levelled to make room for a network of tracks and freight yards."[8] Industrialization was unstoppable. Walk around the Somerville site today, and you'll find desolate concrete flatlands dominated by the railroad hub, high-rises moving steadily upwards all around, locals still shaking their heads at the swiftly changing neighborhood.

The trustees asked Frederick Law Olmsted, who had just designed the mental hospital in Buffalo, to choose between three sites. He selected Belmont for its rolling hills, old trees, "long curves and easy glades," as he wrote, and a glorious, open horizon over the treetops that stretched to Boston. Stand at the entrance of the Administration building today, and you'll feel like Dr. Cowles, the Superintendent who oversaw the campus he helped design, looking out across the bowl, the expansive treetops (and, now, the condominiums) towards the city.[9]

In the course of carefully selecting this site and preparing it for patients, the trees were thinned on Olmsted's advice, per his 1872 letter about the site, and others were planted, the ground levelled in places and graded, working around the rocky outcroppings, to make the place a healing environment for patients to walk and wander. A McLean bulletin article from the 1970s notes that when the Belmont site opened in 1895, "A variety of hardy New England trees—cedars, oaks, maples, and hemlocks covered the 107 acres."[10]

The buildings took three years to construct. They were designed like a college campus, with buildings spread out across green space between old trees, under what was called the "cottage plan," which allowed for the separation of patients depending on severity of illness (and level of noise), as well as space for natural interludes outdoors for walking and relaxation.[11] Olmsted planned for the buildings to be connected by tunnels that rise above ground and divide the landscape into courtyards.

Olmsted may or may not have been involved in the details of the landscape design. On the record, that was left to Joseph H. Curtis. Although Olmsted wrote that he dreaded ending up in an institution, he would return to McLean as a patient for the final five years of his life.

One of the terrible things about OCD therapy is that you have to suffer so much to get better. It's such a cliché: the only way out is through, but for OCD, that's how it works. Exposure-response-prevention (ERP) means you make a hierarchy of all your fears and obsessions, from least to most scary, and you slowly work your way up the list, facing down every single one. You invite the very worst things to happen. You don't allow yourself to ritualize. It's like lying down on a train track and waiting for the train to approach, forcing yourself to stay there, feeling its rumble. You cannot move. The anxiety rises and rises. Before the anxiety begins to abate, ERP feels like torture.

During breaks, I'd go back to my room intending to read a stack of books lent to me by my friend Ellen—Gretel Ehrlich, Amy Blackmarr, Janisse Ray—women who write about the natural world—then quickly fall asleep. I was always exhausted. But one day, I wandered outside. I walked across the patio, over the driveway, and into the bowl, towards a massive tree. It sits at the bottom of that easy hill. It was calling to me, graceful branches reaching out like a mother's arms: I'm here; you're safe. Close your eyes and listen to my leaves.

Leaning against the tree, I could feel its thick bark. I knew it had seen many more years than I had, that its roots had reached deep into the earth, emerging here and there in the grass like strong, gnarled fingers spanning the width of its canopy. It had a strength I longed for, a sense of certainty—something most people with severe OCD almost never experience. It was solid. And forgiving. Both at once. It was what I was striving to be.

Thinking about my time under my favorite tree, as I came to call it, reading the tree map made by patients in 1965-66, considering Olmsted's involvement, and in search of information about the materials used to construct the buildings, I knew I wanted to write

an environmental history of McLean. But, my first few months in the archive, I still hadn't found much about the landscape—until one day, the archivist sent me an email saying, "I left something on your chair I think you'll be interested in." I raced to the archive in the morning to find Margie A. Lamar's "A Study of the History of Landscape Architecture" at McLean.[12] Between the 1970s and 2022, Margie A. Lamar's paper was internally referenced in hospital publications, but never published beyond its walls.

Why did she do this research, and never publish it? Who was she, a woman researching McLean in the 1970s?

Lamar opens her paper by citing Olmsted at the end of his life, back at McLean as a patient: "they didn't carry out my plan, confound them!" She credits this quote to Laura Roper's biography of Olmsted, published in 1973 to wide acclaim for its breadth and depth.

Roper had been working on her biography of Olmsted, *F.L.O.*, since the 1950s, though it wouldn't be published until 1973. Lamar wrote her paper in 1975 as part of her work for a class on landscape architecture that she took at Harvard with Albert Fein, one of the leading experts on Frederick Law Olmsted.

On April 25, 1975, Laura Roper visited Fein's class, and told Lamar that Olmsted did design McLean's campus. Included in Lamar's paper is a reference to "a watercolor sketch, which is, quite probably, the work of Olmsted. It shows the arrangement of the patient buildings around the Administration Building spaced from 55 to 65 feet apart with a 'Pleasure Ground' area indicated, and connected walkways. It is dated November 1875 and is marked 'Study No. 2.'" Lamar defends her claim that this is likely Olmsted's work with reference to several letters he wrote to McLean's trustees and Joseph H. Curtis about the site and design.

Lamar wrote that she hoped that her paper would "contribute in some way to the appreciation and preservation of Olmsted's work at McLean Hospital." She is surprised that, as of the writing of her paper, he hasn't been recognized for his design of McLean in any publications.

After closely analyzing the differences between Olmsted's original plan and McLean's construction, completed in 1895, Lamar determines that, when he said he was dismayed at the hospital deviating from his plans, "he must have [been upset about] this difference of opinion about the placement of the buildings, their distance from each other, and their arrangement around a village-green." She says that it was Dr. Cowles who was largely responsible for "the ultimate placement of the buildings. In reading the trustees reports and the histories of McLean, it is obvious he was a very able and forceful man." In addition, she adds that mental hospitals had to be designed by "'experienced medical men.'" This was because of the rules created by the group now known as the American Psychiatric Association, of which, she says, Cowles was president "at one time during his tenure at McLean." This may have been why Cowles was credited with the design rather than Olmsted. Lamar further suggests that Cowles and the trustees "may have felt Olmsted's original ideas reminiscent of the Buffalo State Hospital," which Olmsted had also designed and was in keeping with the state hospital aesthetic, which McLean was "trying to avoid."

In her introduction, Lamar describes the treatment of mental health in 1872 to have been shaped by "Moral Management," as defined in the late 1700s by Samuel Tuke in England and Phillipe Pinel in Paris. Patients were to be taken to "proper asylums ... a calm retreat in the country is to be preferred. When convalescing, allow limited liberty; introduce entertaining books and conversation, exhilarating music, employment of the body in agricultural pursuits." Instead of being sent to the jails or poorhouses, Lamar writes, "[a]t last the mentally ill were to be treated with kindness in separate institutions." This was the case the Mass General trustees had so fervently made in the campaign to found McLean.

McLean offered all the benefits the Moral Cure espoused, in Somerville and then Belmont, sending patients for walks and time in glorious gardens and under the trees, and assigning them to work in the stables and on the farm, which provided food for both McLean and Mass General Hospital. In the 1960s-70s Disability Rights Movement, such work was outlawed, because it allowed institutions to take advantage of vulnerable people's free labor. But, as Oliver Sacks observed in the 1990s, this also took away many patients' sense of purpose, the worthy contributions they could make between therapy sessions and group meetings, and the chance to stay physically active in camaraderie with other patients and staff.[13] Now, they were left to their own devices, often listless on the wards.

Lamar says she found little about the source of McLean's trees, but that Joseph Curtis, appointed one of the leads on the project by the trustees, was

Ice skaters on "the pond" in Belmont, the flooded dip in the bowl, in the late 1800s, the author's oak at the edge of the frame to right.

"... an engineer for several subdivisions in Belmont from 1872–1910," and might have transplanted trees slated for "removal" from those sites to McLean. Construction files at McLean reveal that in 1893, Curtis contracted with the Shady Hill Nursey Company for "deciduous trees, vines, and shrubs."[14]

In addition to his work around Boston, Curtis was a well-known summer resident of Mt. Desert Island in Maine, where he "co-founded the Northeast Harbor Summer Colony with William Doane and Charles Eliot, then president of Harvard University," and designed several neighborhoods and gardens, including his own home, the Thuya Garden, Asticou Terrace, and a portion of Land's End.[15] Eliot's son became an apprentice to Olmsted and, in 1890, petitioned to save the 400-year-old Waverley Oaks, just across from McLean's campus, which Olmsted references in his 1872 letter to the trustees about the value of McLean's Waverley site. Eliot's argument resulted in the formation of The Trustees of Public Reservations, and then, in 1893, the nation's first Parks System.[16]

Lamar writes that other sources of McLean's trees included Ebenezer Francis Bowditch, one of the trustees, who would select from his "farm in Brookline ... choice fruits and flowers to bring to the hospital." In addition, Joseph Breck and Sons supplied some trees, shrubs, and flowers. Finally, Lamar surmises that because Olmsted's firm was working on the Arnold Arboretum as of 1880, it's possible he may have transplanted trees from there; this is the only claim without any direct evidence. She writes that "Charles Sprague Sargent, founding director of the Arnold Arboretum,... [was believed to have] had a role in selecting trees for McLean," but the source for this belief isn't clear.

Looking back at photos from the Waverley site, this white oak has been here since at least 1895. I hold a lantern slide up to the light of a window, squinting to see ice skaters in the bowl, next to the tree. Because of its large size even at that time, it must have been one of the trees native to this site, one of the survivors in Olmsted's plan to "thin" the wooded landscape into glades.

I take a break from hunching over the table at the archives and snapping photo after photo to document, to slip outside into the sun, and walk down the hill to the old oak. I find a broken bird's egg, the

There's something satisfying about science confirming how good it feels to breathe in the air under tall trees, that shift in the body that comes after a walk in the woods.

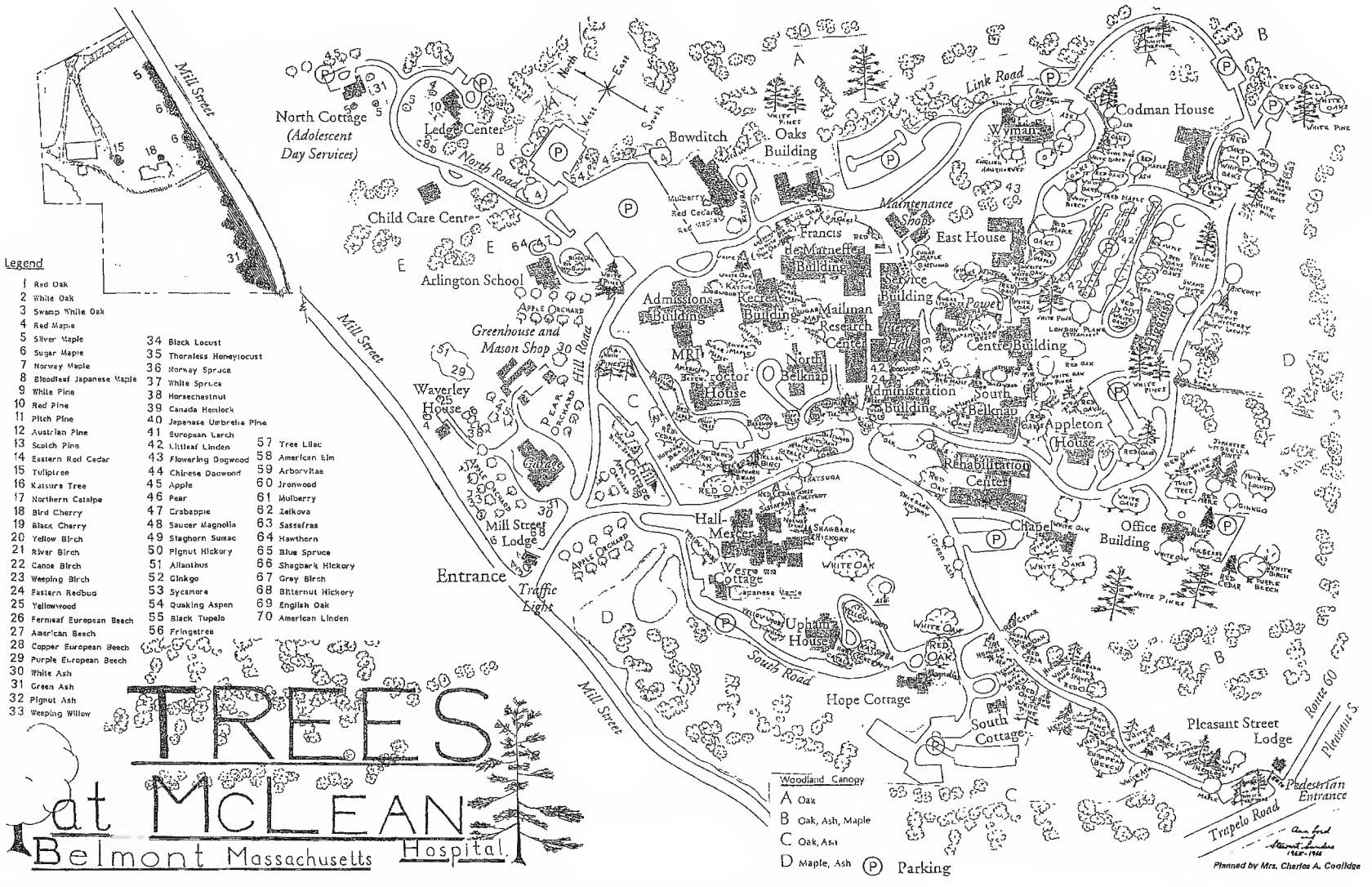
yellow yolk dried inside, and a colony of mushrooms spread out in the shade, making new life. I sit and lean against the bark, listen to the leaves, embracing what always feels, here, like respite from the rest of the world—quiet, rest. Olmsted was right. This landscape does bring patients—at least, me—a sense of tranquility.

Thirteen years ago, at a time when I was being schooled in mindfulness as a way to overcome severe anxiety, I came to this oak for respite, and for lessons. Stand here. Listen. The leaves are moving, the grass is growing, the sun and clouds are shifting above you, written in the shadows that pass over your legs. Faith is a radical act, the ability to believe in what you can't see happening. Faith not in the religious sense but in the spiritual—faith that the world is "not one long string of horrors," as the poet Gerald Stern writes, but ultimately good, that the sun will rise in the morning, that I would survive this time and emerge on the other side. My treatment providers pointed me out of the dark forest in which I was trapped, and I walked, blind, listening to their voices, following every instruction. It took all of my energy to fight, believing my team knew how to get me through. In my downtime, I sat under this tree, feeling still but knowing its cells were multiplying and expanding as I leaned on a trunk that looked and felt massive, immobile, and permanent. This tree couldn't possibly be moving. But it was.

Researchers have known for decades that walking under trees benefits our health. The pandemic and our time forced outdoors popularized the Japanese concept of shinrin-yoku or forest bathing, "walking under the trees and breathing the air" or "immersing oneself in nature, using one's senses."[17]

A 2022 survey of the shinrin-yoku literature found that the most accurate results document the benefits for people suffering from anxiety and depression. That research is now expanding to assess the effects on people with other mental health challenges, including those at mental hospitals.[18] Other scientists have documented the value of monoterpenes, chemicals emitted by certain plants that decrease our stress levels.[19]

There's something satisfying about science confirming how good it feels to breathe in the air under tall trees, that shift in the body that comes after a



Map of the trees at McLean made by patients Ann Lord and Stewart Sanders with trustee Mrs. Charles A. Coolidge in the 1960s.

walk in the woods. That feeling of calm is now documented: We are being changed at the molecular level.

This recent science confirms what psychiatrists and health care providers have known for centuries: trees benefit our health. These were all the same prescriptions given by the founders of the hospital in the days of the Moral Cure. Looking at 1880s photos from the Somerville site, we see women standing under the trees with walking sticks, waists cinched in their dresses. A group looks over the edge of a bridge at the pond below. They also spent time weaving in the loom room, looking at art in a space curated by one of the trustees, playing tennis, and ice skating. And just as women at McLean were told to do in the 1850s, when I was at McLean in 2010, we were taught to get outside, move our bodies, and practice what we call today mindfulness, focusing on the present moment. We took up hobbies we'd lost along the way.

Those traditions gained even more force in the 1960s. In the midst of the national environmental movement that had begun to take hold in the wake of publications such as Rachel Carson's *Silent Spring*, patients Ann Lord and Stewart Sanders collaborated with trustee Mrs. Charles A. Coolidge to make a remarkable map of the trees of McLean. Coolidge lived right across the street from McLean in the 1930s while raising her children with her husband, Charles Coolidge, Jr., a descendant of one of the architects who designed many of McLean's buildings. Charles, like his wife, seemed to be committed to preserving the town's natural spaces, as he served on the new Belmont Conservation Commission in 1967.

Perhaps the Coolidges were inspired by the revival of interest in Olmsted's work in the 1950s and 60s, which, writes the editor of Fein's 1972 book on Olmsted, "a group of scholars ... are chronicling and illustrating ... for the benefit of the new environmentalists—for many of whose ideals Olmsted is the prototype." Fein writes that it's only natural that Olmsted should be revisited in the wake of the "three major crises undergone by this nation during the last decade—racial, urban, and ecological."[20]

Today, with the ongoing Black Lives Matter movement, the mental health crisis brought on by the pandemic, and the climate crisis, we are in not so dissimilar times. We sit at another axis, the intersection of environmental and mental health research, focused on how the environmental crisis impacts

all of us around the world, particularly those losing their lives and homes in the southern hemisphere. Researchers are focusing on what we can do to prevent climate change and mitigate the damage for those who are losing the most even though they hold the least responsibility for its cause.

Walking back onto McLean's campus last year was a strange experience, jolting me back to the time I stayed at NB1, sleeping on a twin mattress in a room with a teenager who was fighting similar demons. But, just as I learned that exposure therapy brings the abatement of anxiety, allowing me to finally laugh in the face of my OCD (Take that! I began to think when an exposure was done), I found that coming back to the hospital wasn't scary at all. It was full of stories. Just as McLean was designed to be a home, as Lamar writes, so it became one for me—first when I went to the OCDI, and now that I've delved into its archives and rested, again, under its trees. I have been very lucky.

For years after I left McLean, I pressed ahead, trying to make up for lost time. I had a doctorate to finish, a job to earn, tenure to race after, and finally, the exhilaration and exhaustion of single motherhood consumed me. Now, enough space has passed between the years I was sick and today, with so much other work done, that I can inhabit the space again—differently, full of curiosity.

Mama, my child asked on a recent walk through the city, when I insisted we stop and look up at a tall old oak tree, *Do you wish you were a tree?*

I laughed. It was a fair question. We spend a lot of time looking at trees together.

No, I say, *but I do love them.*

On my breaks from the archives, sometimes, I go back and visit the white oak. I sit under its ever-widening branches, marvel at the mushrooms emerging in June, peek in at the massive hollow where the trunk split apart, and then I sit and listen to its leaves for as long as I can. These days, I only have a few minutes here and there for quiet interludes.

McLean's site in Belmont is the result of the onslaught of environmental damage caused by the industrial revolution's second wave, with the railroads and meatpacking plants housed at the original Somerville site. The first time I drove through the old site, now called Inner Belt Park, I saw it as desolate, a contemporary wasteland, the sad castoff of industrialization. But now, returning in early spring, I see something else: rows of trees. They're saplings, still, but someday, I hope, they're going to line these roads as elders, and someone will walk under them, and wonder how they came to arrive here. Someone will dig around for the stories. Someone will unearth their histories. Maybe. At the very least, they're offsetting carbon emission and improving our air, giving us shade and some beauty. Walk up close, and you'll see the moss and lichen already forming on their bark, as if they're all making themselves at home. This, to me, is hope.

I get up and walk away from my favorite tree, meander across campus to my car, and drive back to Somerville to wait for my child to emerge from school, into my outstretched arms.

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This piece is for Thea Cawley and Leslie Shapiro, with gratitude, and in memory of Dr. Mike Jenike.

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A Beech Walk on the Brink

By Anelise Chen

The American beech tree bears an uncanny human semblance with its skin-like bark, muscular torso, and solemn, watchful eyes. The gray-blue bark, smooth as paper, so well preserves the razor's trace of past loves and proud exploits, that from the word beech we get the Anglo-Saxon word for "letter" and "book." The practice of scratching runes onto beech bark fixed the medium with the act of reading, so that reading became inextricably tied with the tree. By Shakespeare's time, the paramour Orlando would declare, "O Rosalind! These trees shall be my books, and in their bark my thoughts I'll character." We were once practiced at reading beeches. Early European settlers in America learned that beech forest meant rich farmland and plenty of game, as passenger pigeons and turkeys descended in fall to feast on their nuts. The beech told of the past but promised the future. In Audubon's famous illustration of a pair of passenger pigeons, painted while he was in Kentucky and besotted with his young wife Lucy, he placed his kissing birds on a beech bough during autumn; they crane their necks lovingly toward one another in an image of conjugal bliss and continued generation. Nothing seemed more natural. The thunderous pigeon flocks would never end, just as the beech forests would never end.

Of course, we know what happened to the pigeons. The last of its kind was shot down by an unsuspecting boy; the rest persist in their twilit immortality as taxidermy specimens displayed under florescent lighting. The raucous flocks that once darkened the sky linger on only in the dim dusty halls of our collective consciousness. And what became of that breathing, rolling sea of unbroken beech forest? Naively, I thought: These trees will be here longer than we will be. Little did I know, the next chapter of the beech's story was about to take a darker turn. Did I want to keep reading? Did I have a choice? It seemed that I had fallen in love with beeches just in time to learn what there was to lose.

As birders have "spark birds," or birds that catapult something wondrous and previously hidden into the foreground, so should tree lovers have "spark trees." One of the first trees I learned to identify was the American beech. Before, trees entered my awareness only when I needed shade and found it, usually in a sweltering parking lot, or when they arched over a city street.

All this changed when I met my husband. He owned a nursery—(the kind for raising plants, not small children). On one of our first dates, he asked if I wanted to pick up a plow with him in New Hampshire. The

Interveinal discloration, the clear sign of beech leaf disease. *Photograph by Robert Marra*

strangeness of this task was very exciting to me, as I texted my city friends, who understood the figurative use of this word (*ahem!*). At the pickup, I hung around awkwardly as he and the plow guy chatted about the "weed cultivator" (a marijuana start-up company?); "topsoil" (award-winning soil?); and "deer browse" (I imagined choosy deer circling supermarket aisles). Their brief exchange brought me back to my childhood as an English-as-a-Second-Language-learner, my brain firing up images in vivid, if absurd ways.

After completing the errand, we went on a short hike. It was December and the wind blew cleanly through the open woods. The whole place smelled like fresh snow on a wool jacket—as I described to him laboriously—recently spritzed with a pine or cedar cologne. At least, that was the closest analogue I could reach, with my synthetic, nature-deprived senses. Weaving our way down towards the ravine, I heard a rattly sound that I liked. What is that? We stopped and listened. Pleated, dun-colored leaves shook percussively on pale branches, and with each rush of wind, a lovely susurration followed in a soft crescendo. *Shhhhhh*. It was like someone running the tips of their fingers through your hair.

He said that these trees were American beeches—*Fagus grandifolia*—and that they were unique to the landscape because they held on to their leaves throughout the winter. He offered a new word—marcescence—for this dead-but-still-attached state. "Do you want to know another fun term?" (He knew he was dating a writer.) "The cone of juvenility. That means the tree holds on to its leaves in a triangular cone shape. See there, in the middle?" He pointed. Suddenly, I could see the phenomenon he was naming. What I took to be the outline of the tree was actually a ghostly inner tree of leaves, with the outer branches bare. Another pattern floated up to the surface like one of those posters of optical trickery. I saw branches splitting outward, recalling a satellite image of an alluvial fan. This branching mirrored the veining of certain leaves, he said—reticulate venation. And? I pointed. What was this leaf edge? Toothed. And what was that bark doing? Exfoliating. Basically, I was helpless for this kind of thing.

I have since learned that beech is one of the easiest trees to identify. In that sense, it's the perfect spark tree, with a low, unintimidating barrier-to-entry. In the months that followed, I, former-tree-ignoramus, became a child again. "What's that?" I'd yell during our afternoon runs. "What's that?!" We would have to stop, and he would have to identify the plant or the tree, like my own personal iNaturalist app. Then I'd go home and read about it. One spring morning, I gasped. By this point I knew well the names of familiar species, but as much as I'd read, I had never actually *seen* beech flush its new foliage. It was psychedelic. The trees were all wearing hi-vis vests, studded with reflectors and shimmering wildly. It was like I was on LSD at a rave and the strobe lights were going. Splays of new foliage branched out laterally, energetically, one on top of the next like palms facing down in a team cheer. A week later, that breath-seizing, gut-punch neon mellowed out into a more composed and stable green. Summer arrived, and by then the foliage had deepened into such a lustrous, stately, heritage green—I thought of old billiard rooms with all the curtains drawn, cool and dark.

In the fall, the beeches transformed yet again. "What's that!?" I muttered to myself one afternoon, looking up. I heard the *clink clink clink* of a million beechnuts exploding and falling to the ground, the blue jays screaming overhead, ecstatic at the bounty. I had recently begun "to bird" (a verb!) and identified in my binoculars that the nuthatches were also feasting away. Well, if it's good enough for them, I thought, and bent down to inspect the beechnuts. I rolled several of them around in the center of my palm. It tickled. The outer covering of the fruit was brown and prickly, but opening up the husk, there were two, three pinched ingots of nut meat crammed inside. I put one in my mouth and chewed. It was sweet.

"Why, we might as well ask, not a plane tree, instead of a bo?" Annie Dillard writes in her nature writing classic, *Pilgrim at Tinker Creek*. "I never met a tree that was no tree in particular." Here, Dillard is puzzling over an important question in Christian theology, wonderfully referred to as "the scandal of particularity." The problem is that Christ had to be born on a specific day in a specific place to specific parents, while also being God incarnate. Why bother giving God details? Is there any higher purpose in knowing that it's a beech, and not just any old tree? I think that any ex-tree-ignoramus like me can understand that a capital T idea of a Tree does not allow you to truly love it, just like it's impossible to love a generic God or a generic Man. No: you end up loving this man, the way he laughs at this exact joke, just like you love that exact beech over there around the bend, that one covered in steroidal folds of muscle like an overzealous body builder.

"The trunk is crudely etched with a filled-in heart, which makes me wince"—beech trees near the entrance of West Rock Ridge State Park. *Photograph by Angela Chen*

For better or worse, my world began to fill with that pesky scandal: particularity. Now, I could say with some confidence that I loved the red mitten leaves of sassafras in the fall, and the way they smelled of root beer at the stems. I loved the improvisatory shapes of oak leaves, which could be assembled on the wet sidewalk like Matisse cut-outs.

But the trouble with loving a particular is to accept the attendant risk of mortality. I think often of Zadie Smith's essay on joy, where she describes the everyday madness of falling in love. You can't look into a child's face, or your spouse's, without simultaneously imagining their loss. But to stay sane and functional, you can't think about that all the time, and must live as though their demise should never come. With love, "it hurts as much as it is worth." As I paid more attention to the natural world, I began to realize that the same principle applied. To tune into the daily show of a sugar maple was to worry whether it was holding up okay in the drought. To thrill at the sight of bloodroot was to worry whether it would appear again next year, blooming as it was amid the thicket of garlic mustard. Paying attention provided endless rewards, but every day I was discovering new sources of grief. This was the bargain I had struck.

One spring day during the early stage of the pandemic, while walking in my local park in New Haven, I noticed a young beech with mysterious dark bands on its foliage. With the sunlight shining from above, I could clearly see the alternating stripes. At the time, I misread the phenomenon as leaf variegation, thinking I had stumbled across a rare specimen of beech. I geotagged the tree with the intention of showing my husband, but a few weeks later I saw another beech with the same interveinal discoloration, then another, then another.

Research led me to conclude that this was no genetic mutation, but rather, the signature symptom of beech leaf disease. Caused by an invasive foliar nematode (*Litylenchus crenatae* ssp. *mccannii*) and first detected in Ohio in 2012, the disease had swept east to Pennsylvania, New York, Connecticut, and Massachusetts, then northward to Maine, with astounding speed. It causes leaves to emerge damaged in the spring. Without working leaves, the tree starves, unable to photosynthesize.

"Defoliation is so severe it looks as though the leaves have melted off their limbs"—as the disease progresses, trees lose their ability to photosynthesize. *Photograph by Robert Marra*

It's only been three years since I first noticed beech leaf disease in East Rock Park, and already the defoliation is so severe it looks as though the leaves have melted off their limbs. Desperate to talk to an expert, I reached out to Dr. Robert E. Marra, a forest pathologist at the Connecticut Agricultural Experiment Station who has studied beech leaf disease since it arrived in Fairfield County in 2019. His name was mentioned in numerous articles I read about the disease, but mostly, I reached out to Dr. Marra because he seemed like the type of guy who wouldn't mince words. In a Power Point presentation of his that I dug up online, I was struck by his candid descriptions. "The 2022 BLD Hell-scape!" begins one slide, in drippy, horror-movie font. In my introductory email, I said that I was interested in his perspective as a scientist as he worked against seemingly unstoppable forces. I wanted to know how he was coping emotionally.

On a cool May morning, Dr. Marra meets me in the lobby of the Connecticut Agricultural Experiment Station (CAES). He is wearing a tweed driving cap and a warm sweater-jacket, as the air still has a bite to it. Our plan is to drive together to West Rock Ridge State Park, where he often collects leaf and bud material to take back to the lab. We walk out to his car, a red hatchback stick-shift of unidentifiable make and model, plastered over in political bumper stickers that place him firmly on the left of the political spectrum. Before I get into the passenger side, Bob heaves a paper bag filled with nut bars into the back seat. He explains that he volunteers by ferrying unsold food to those who need it, making runs from the Big Y to the local addiction treatment center. "This is an environmental movement as much as a social justice one," he says. He keeps this food in the front seat in case he sees panhandlers on traffic medians.

"Do you know about Atticus Bread?" he asks. Atticus is the upscale café-bakery in East Rock where you can buy things like a wood-handled Opinel foraging knife and nouveau-ethnic fare like frozen cheddar jalapeño pierogis topped with truffle chili crisp from Momofuku. Atticus is one of Bob's regular unsold-food pick up spots. "The other day, I roll down the window and ask this guy, 'Hey, you want this tofu banh mi from Atticus?' He goes, 'Hell no!'" Bob cackles. "Often people tell me, beggars can't be

Paying attention provided endless rewards, but every day I was discovering new sources of grief. This was the bargain I had struck.

choosers, but I think, hey, he's just trying to preserve his dignity."

I decide I like Bob immediately. During the drive, he's telling me about this lady who dumpster dives illegally and how nobody can get her to stop. "She's just great," he beams. Supermarkets deter divers by throwing rotting cabbage in with the stuff that's perfectly alright, Bob rants. "We're feeding human beings! We're not feeding pigs!" There is an irreverent impishness to Bob's whole demeanor, which I had not expected from a forest pathologist. Not that I knew what forest pathologists would be like, but I had imagined that being around death and disease all the time would make one dour.

After we pull into the parking lot at West Rock Ridge, we head toward the coppice of beeches by the entrance. Bob had warned that we might not see any beech flush their foliage, both because of the disease, and because beeches are unpredictable. They can be "squirrelly," and even healthy beech don't flush all at once. Now we are about to find out. There is a "mother" tree here, about fifty feet tall, with many smaller trees underneath, either clonal sprouts suckering from the root system, or seedlings. When I look closely, I see the "mother" tree is in fact two trees, long since grafted together with a branch bridging the gap, like a couple with their arms around each other. The trunk is crudely etched with a filled-in heart, which makes me wince.

At this time of year, the canopy should already be filling out, but sunlight shines through the canopy, and I can see blue sky and the contrail of a plane passing overhead. Bob pulls down a branch from one of the younger trees, about eight feet tall. He says that last year, these trees were the last to exhibit symptoms. This year, there are some newly emerged leaves on the branches, but they look a bit curled and misshapen, like microwaved plastic. Bob puts a finger to the long, quill-shaped buds, wrapped in a hard brown sheath. Before pulling it off to show me, I notice him hesitating. "I hate to deprive this guy," he says regretfully. Normally, new growth emerges from these buds, an entire branch with innumerable new leaves to photosynthesize, similar to the way a tiny, fingernail-sized embryo can grow into a full-sized adult. Without the bud, new leaves will not emerge; without new leaves, the next year's buds, which develop at the base of the new leaf, do not appear. Cycle after cycle of this causes branch dieback.

"I'll harvest this one, but it might not be viable anyway," Bob reasons. Sure enough, the bud falls off without any resistance. He explains that some buds are so ridden with nematodes that they will simply "eject" or "abort." We look down. The ground is littered with aborted buds, scattered among last year's dehisced leaves that all have the disease's "canonical symptoms." In the litter, there are also husks of beech nuts. Since it takes up to fifty years for a beech to reach maturity and produce nuts, these trees have been there at least that long. I remember reading that stressed trees often produce a final crop of nuts before succumbing to death. With every step, the leaf litter crunches underfoot, and I wonder if these beech leaves, nuts, and buds will be the last of their kind.

I decide to step more carefully. We have to shout over the shriek of chainsaws from tree work that the parks department is doing somewhere. I look at the bud in Bob's palm. I tell him that I simply can't wrap my head around what nematodes *are*. Bob laughs. "Nematodes are an entire phylum, as diverse as the phylum Chordata, which we share with fish and tunicates," Bob says. "A phylum! Imagine the variety."

In other words, nematodes are as different from one another as a hagfish is from a peregrine falcon or

Dr. Robert Marra pointing out new growth with signs of beech leaf disease and the small size of the buds. *Photograph by Angela Chen*

a tiger. While it's impossible to say what a nematode is, in essence, they're worms. *Placentonema gigantissima*, a nematode that parasitizes blue whales, might be ten or fifteen meters long, while the majority of nematodes are microscopic and they're not always parasitic. Nematodes can live anywhere: in soil, in leaves, in the intestines of other animals; from the ice of Antarctica to arsenic-poisoned Mono Lake. Maybe five or ten percent in total have been identified. It has been suggested that if you collected all the nematodes in the world, it might weigh the same as eighty percent of the combined weight of all humans.

Later, I will spend time with Bob at the lab, where we will look at *L. crenatae* under the microscope. He will float the leaf and bud material in water to encourage the nematodes to swim out. At first, with the naked eye, I see what looks like tiny motes of trembling dust in the water dish. Under amplification, the full horror of the invisible world comes into view. Worms. Worms. So many worms. They look like snips of colorless, translucent thread, but undeniably alive. The nematode's signature move is to thrash, which they do vigorously, curling from a letter C to a bass clef symbol over and over again. They're full of lipid molecules that they just burn up, thrashing until they find a carbon source. At the feeding end, they have a retractable stylet that is used to puncture the cell wall, and they emit effector molecules that cause the cell to expand. The nematode will feed at the site, using the stylet as a kind of straw, sucking up the sugars in the photosynthesizing cell. By the time the nematodes are through, the leaf or bud tissue is destroyed, either from their feeding or their movements. Under microscopic magnification, the cellular structure of a normal leaf looks like tubes of macaroni stacked vertically and horizontally, but with nematode damage, the cells look like smashed cardboard pulp.

Back at the forest: Bob says nematodes are an *r*-selected organism, meaning their evolutionary strategy is to produce massive amounts of offspring in the hopes that some lucky few will survive. *L. crenatae* females can recreate sexually by breeding, but also parthenogenically. In other words, they can make clones of themselves by laying eggs without male fertilization. The hatched juveniles feed, grow, and reproduce, the average life span lasting approximately two weeks. By the end of the summer, some

leaves have been found with as many as 50-60,000 nematodes crammed inside. In a microscope image in which the worms are dyed pink, the image looks entirely pink, with hardly any leaf tissue visible.

If one finds these numbers staggering, their resiliency is equally hard to believe. "These nematodes are tough," Bob says. "They have been found buried under layers of leaf duff, under snow, and successfully revived in the lab! They can survive the intensely cold temperatures we've had this past winter. You can centrifuge them for 30 minutes and when you look down on them through the microscope, they're still swimming off the pellet. That's 20,000 rpm! We could not survive that."

All this is part of the ongoing, working story on how the nematode persists and spreads. Bob paints the following scenario: Imagine that it's late summer, with nematodes crawling all over each other in the leaf. It's crowded. It's becoming harder to feed. Those at the exit desperately need to get out. Some do fall out. Then, there is a rain event. Water splashes down on the leaves, and the nematodes quickly emerge from the stomates and travel in water, thrashing and thrashing. Some might get picked up by an insect, like a leaf hopper or a spider mite. Others might get picked up by a squirrel's tail, or a bird that is able to fly for miles across water. Beech leaf disease has been found on islands like Fisher's Island, which seems to support the theory that the nematodes must be hitchhiking on bird's feet, but Bob says that at this point, it can be assumed that these nematodes are sticking to anything that happens to visit a beech tree.

"But there's a lot we still don't know. We still don't know how *L. crenatae* arrived. We still don't know exactly how it spreads, even if we can hypothesize. To find out, we would need to be trapping birds and banding them and washing their feet. And washing the tails of squirrels. Can the nematodes fall to the ground but then climb up a tree? We can't band a nematode to see where it goes."

He notes that the beeches are also doing something that has never been witnessed before in beech. In response to the defoliation, they are sending out a "second flush" of leaves, which sprout in unexpected places, such as directly from the branch or trunk. These second flush leaves are lighter in color, without the signature toothed edges. Bob says that these leaves "never look quite right."

All of this information is mind-boggling. I suddenly start to see the forest with nematode goggles. They're simply everywhere, maybe even writhing on my hands, where I had brushed against the leaves. We continue hiking up the trail, following the path of the creek. Bob tests the branches by bending them slightly to see if they're still alive. Dead, snap. Dead, snap.

"This tree is not going to survive," he says. "There will be root dieback as well. In a stressed tree, fungi in the soil will start to degrade the wood. It's equivalent of a dead tree standing. Oh, wait. There's one little leaf. One."

Here, I ask Bob: What would further beech decline mean for the ecosystem? Again, Bob emphasizes that we simply don't know. We don't have a precedent for this kind of foliar nematode for trees. Beech is a common denominator in so many of our Northeastern hardwood forests, and plays a unique role in the forest that can't be quickly replaced. Without beech mast, the bears, porcupine, blue jay, and grouse will lose a major caloric source. And the hundreds of caterpillar species that rely on beech, such as the early hairstreak caterpillar that can only feed on beech leaves, will essentially disappear.

I press Bob further here—yes, sure—but what would this mean? I am hiking behind him so I can't see his expression, but there is a beat of silence. We both know that mass tree-mortality events have been on the rise around the globe, a percentage of that due to invasive pests. In the west, bark beetles have affected millions of acres of forest; across North America, the emerald ash borer will likely to destroy all eight billion ash trees; the wooly adelgid is ravaging hemlock forests as we speak. Now there is a new pest on the horizon, the elm zigzag sawfly. What would it mean if all the trees we love simply—die?

Bob turns around and shakes his head. Unfortunately, he's a scientist, not a political forecaster—it's a fool's errand to try to predict what's going to happen. But he ventures diplomatically that, undoubtedly, the composition of this forest will change. He shows me what some of those changes might be: In the sun pockets, we see young sassafras reaching toward the gaps, and tulip poplar shooting up. The shade-loving mountain laurel won't do well, but witch hazel is doing okay, which reassures him. This forest is still relatively healthy, but in parts of Fairfield County, the understory is solid green with invasive barberry. Bob stops before a black birch to say that birches will likely increase; deer don't like to browse them due to their wintergreen smell. In the past, wintergreen oil was distilled from the bark, and the wood was

"We don't want to acknowledge what we're seeing"—Bob Marra. *Photograph by Angela Chen.* Above right: Nematodes recovered from beech buds. *Microphotograph courtesy of Paulo Vieria, USDA-ARS Beltsville, MD*

commonly used as veneer for furniture, since it could be made to resemble woods like walnut or mahogany. He shows me a canker-covered birch that looks like it has been blasted with a bazooka. Obviously no good for veneer.

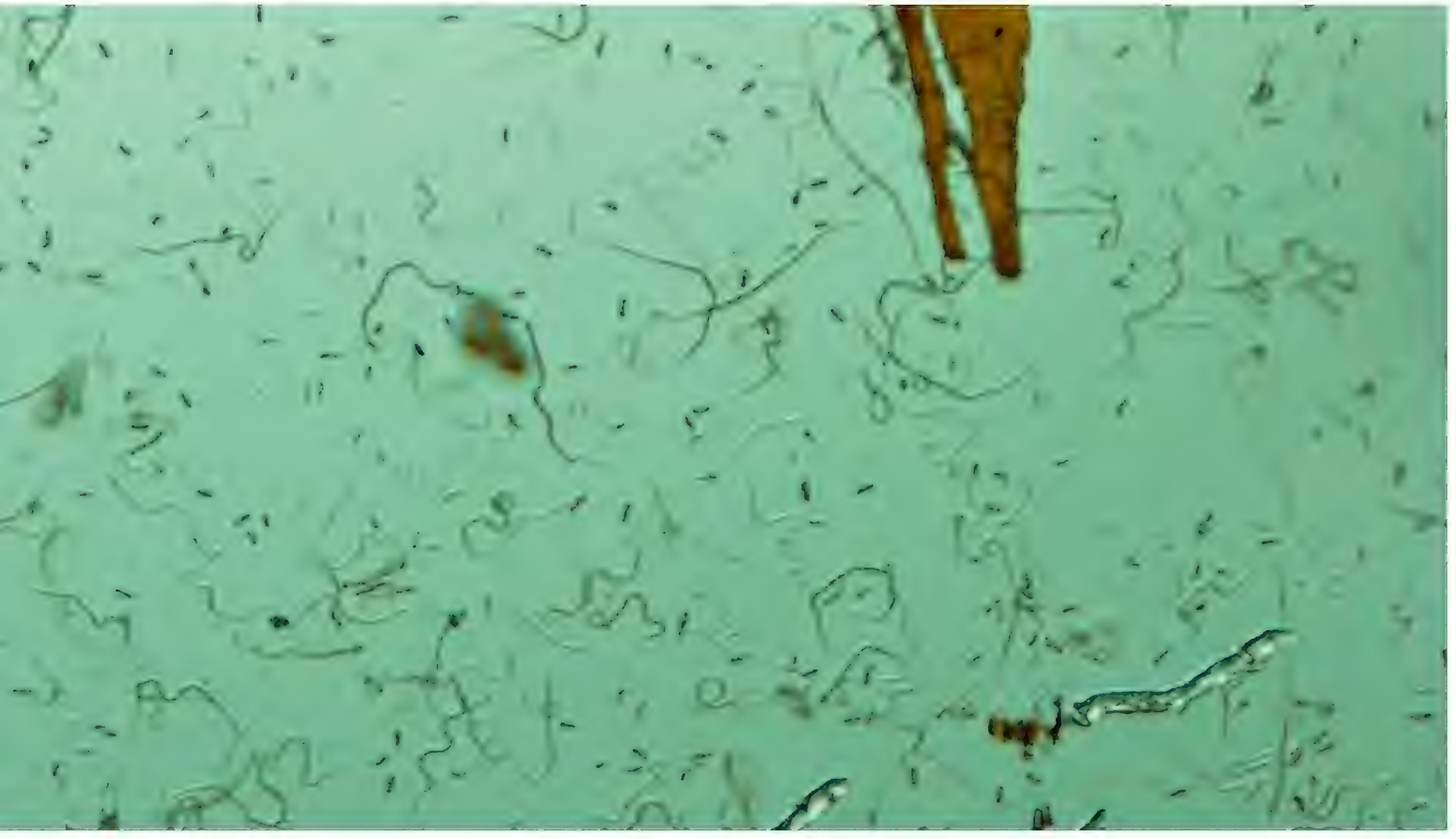
For now, the nematodes aren't Bob's only concern, far from it. "You know what I'm most scared of?" Bob says. "I'm terrified of oak wilt. It can kill in a season. It's knocking on our door. In Texas, which has some of the highest diversity of oaks, they're really struggling with it. Municipalities spend millions of dollars every year to trench around the tree, because it can spread through the root system. We can't do that kind of work in Connecticut, with our rocky glacial till. The trenchers couldn't handle it. Tree wardens have already reported oak wilt in Long Island, Brooklyn, Albany. It's here. We never learn our lesson. By the time we ID the threat, it's usually too late to control it. If we lose our oaks, I just don't know ..."

As we walk and Bob continues pointing out what he sees, I think of the relative, merciful ignorance of non-specialists. Where he sees cankers and nematodes and pathogens, the common hiker sees only "nature." Aldo Leopold often lamented humanity's seeming impotence in battling invasive species that we ourselves have introduced, especially because we have no ability to see the difference. He wrote in the first, unpublished foreword to his 1949 classic, *A Sand County Almanac*:

> One of the penalties of an ecological education is that one lives alone in a world of wounds. Much of the damage inflicted on land is quite invisible to laymen. An ecologist must either harden his shell and make believe that the consequences of science are none of his business, or he must be the doctor who sees the mark of death in a community that believes itself well and does not want to be told otherwise.

I must also be one of these laymen who explicitly "does not want to be told otherwise." By reaching out to Bob, it was as though I had rushed to the doctor expecting to be met with a benign diagnosis or at least with curt dismissal, waiting to be told that, in fact, I'm healthy as a cow. But in this situation, Bob is telling me that it's worse than I could have imagined.

On any normal day, I tack my survival on the hope that resilient new species will fill the gaps to thrive



in the hostile environments of our creation. In the city, mulberry seedlings shoot up through concrete; *Ailanthus* livens up the desolate, trash-blown margins of rail yards. This distorted urban ecology is still an ecology, and one that should be embraced. Right? Perhaps I came searching for the scientist's perspective with a childish desire to be told some version of this comforting bedtime story. But now I realize that ecological change is easy enough to embrace in the abstract, but the actual experience of loss is another thing entirely.

"The speed at which beech leaf disease is moving through the East is shocking!" Bob nearly shouts. "Six years ago, if you'd asked me if our beeches were okay, I would have said, yes, they're doing just fine! Now, it's possible we'll lose this. All of this—" He makes a grand sweeping gesture. "We don't want to acknowledge what we're seeing. Our forests are slow-motion crashing. Twenty years ago, we would have had to talk louder. We would hear birds, insects! I'm 67. This is within my living memory. I remember there used to be so many warblers here, I'd be so frustrated thinking, please! One at a time! I can't identify you. Now, I hear one small Tennessee Warbler. Otherwise, it's silent."

We stop to listen. I hear the steady roar of the Merritt Parkway, and the buzz of chainsaws.

"It's like we all have our heads buried in the sand."

I stare beyond the trees, trying to unsee what I now see. Bob says the nematodes are essentially "soiling their beds." It's not a good evolutionary strategy to kill off your only host, yet that's what the nematodes are doing. We are talking about nematodes but I can't help but think of *Homo sapiens* and our own relentless chomping up of resources. We might end up following the same fate, soiling our beds, destroying everything that gives us life.

"Yeah. People ask me if I'm depressed sometimes. I'm like, sometimes? How about all the time?"

A flock of blue-black grackles sails across our vision in a diagonal configuration through the woods. Their iridescent shapes animate the hidden space between the trees like tatters of fabric.

"I miss the winters we used to have," Bob says after a while.

"Just don't make me wear a lab coat, like the TV crews always want me to do!" Bob exclaims when we arrive

back at the lab, after I tell him I'd like to take some pictures of him "at work." Science is to be conducted while wearing regular clothes. We have returned to the Connecticut Agricultural Experiment Station, where Bob does the daily work of DNA fingerprinting to try to develop theories on pathways of spread. Bob would like to determine whether there was one introduction, or several. The data, for now, show that it's not all clonal reproduction, but it's also not highly diverse. Which indicates that, at least with these data, the nematodes are closely related. But there's still so much sampling to do. Science is a routine grind, the repetitive motion of putting this thing into that thing and spinning it and logging it: rinse and repeat. Time is a resource that's finite. Bob doesn't join the mass exodus out of the office at 4:30. He desperately needs another technician.

In between microscope slides, we chat about the conflict in Ukraine, the rogue generals launching Sudan into a civil war, the lectures of Timothy Snyder on the rise of fascism. Everything in the news is terrible.

"But how do you rationalize to yourself what you're doing, when the going is so slow?" I ask.

Bob leans back in his chair and crosses his arms, a thoughtful expression falling over his face.

"We don't have forest-wide ways of dealing with disease. So, what are we doing? I think that we're historians. What we can do is document what we're seeing, so we can better understand this process. If there's a next time, then maybe there will be all this research already."

On our human time scales, we refuse to acknowledge that something can't be done, that solutions can't come faster.

On our human time scales, we refuse to acknowledge that something can't be done, that solutions can't come faster. Back home, I begin reading a history of the American chestnut (*American Chestnut*, by Susan Freinkel). If we can't know the future, perhaps we can read about the past to extrapolate some common themes, to compare and contrast. What happened the last time a beloved American tree faced such a threat?

The storied chestnut was America's "perfect" tree, representing both a livelihood and a way of life. When the blight arrived, the government mobilized tremendous resources to try to save it. However, while all agreed that something had to be done, there was no consensus on what that "something" should be. William Alphonso Murrill of the New York Botanical Garden led a coalition of scientists who argued that the path forward was to continue collecting more data. Another faction of scientists, politicians, and action-minded industry professionals demanded more aggressive measures. The standoff between the dueling parties came to a head in Pennsylvania, where the Commission decided that the way forward would be to cut down every single chestnut, sick or healthy. In retrospect, perhaps some of the chestnuts would have developed immunity, and survived.

The rest is history. The blight burst through quarantine lines. A plant pathologist, George "Flippo" Gravatt, was put in charge of the Chestnut Blight Laboratory at Virginia Polytechnic Institute and State University in Blacksburg—a thankless job, where, for three decades, during the prime of his career, Gravatt was "one of the chief chroniclers of the tree's sad, slow demise." He "bore witness over the years to a steady march of destructive invaders," Freinkel writes, which included pine blister rust, spongy moths, and Dutch elm disease.

I wonder about a life spent chronicling death. It's like that question posed by German writer Judith Schalansky's book, *Inventory of Losses*—who is closer to life? The person who thinks about her mortality all the time, or the person who manages to suppress all thought of it? Gravatt's sense of duty to witness

reminded me of what Bob said about his job as a historian. From the vantage of three decades, a single human generation, what he's doing might seem utterly hopeless, and closer to death than to life. Yet, a hundred years after the fact, Gravatt's work was clearly valuable, a gesture towards life. At this jump, we actually can think more in the timescale of a tree, or a forest. There is more hope today than there was a century ago, with continued breeding programs and, yes, more data. Perhaps, one day, the blight will be weakened enough from its own virus that the chestnut sprouts will finally make a comeback, as predicted in Robert Frost's poem "Evil Tendencies Cancel":

> Will the blight end the chestnut?
> The farmers rather guess not.
> It keeps smouldering at the roots
> And sending up new shoots
> Till another parasite
> Shall come to end the blight.

An appropriate addendum to the poem may have elaborated that the farmers—or those who witnessed the decline firsthand—wouldn't be around themselves to see the rebound.

All summer, wildfires burn and beech trees die; I shut my windows against the smoke; I move words around on a page; I play with my son at the playground; we eat dinner and take baths and go to bed. Scientists are modern-day Cassandras; most of us can't bear to hear them declaim the endless daily tragedies that seem beyond our control. As for me, I even avoid thinking about the roof gutter that needs to be replaced. A torrent of rainwater pours over the brownstone façade during every storm, seeping moisture through the cracks. It's a big job that will require the hiring of reputable contractors, and we just keep kicking it down the road. Fixing it necessitates the leveraging of present pain against future pain. It occurs to me that if we can't even deal with basic repairs in our home, what hope do I imagine for the planet? Perhaps we truly are as shortsighted as nematodes. But the instant I go outside, I feel immediate joy upon seeing the brown sandstone blooming with life after rain. A miniature forest of mosses has sprouted overnight, a glistening fairy world. Life and decay. It's all here.

I call Bob to see what's going on; to hear the latest in beech tree news. Since the last time we chatted, Bob has begun to brainstorm ways of engaging land trusts to deploy a polyphosphite treatment that researchers in Ohio have demonstrated can enable trees to protect themselves from nematode damage and preserve fairly healthy canopies. They still don't know how the treatment works, but the effort might preserve genotypic diversity, he says, because the classic problem with species saved from the brink of extinction is that they end up in a "bottleneck," representing only a sliver of the original population diversity.

"It's because people kept asking me, what can we do, what can we do to help you? It's so hard to turn people away, but it's not like you can come help me in the lab. It's horrible and we're heartbroken, they say. Well, then let's all think what we can do."

Bob says that even though saving individual trees seems like a daunting task, if you divide up the work, then it's not so bad. What if volunteers could, with his help, identify individual trees they'd like to save, then apply the phosphite soil treatment twice a year? These citizen scientists would be tasked with monitoring the plots and collecting data.

"We're not going to give up," Bob continues. "We're just being realistic about outcomes, but we're not going to give up. When you get a group of people together who care and can think creatively, they come up with solutions...." Bob is referring to the beech-leaf-disease working group that he's a part of, and the many land trusts mobilizing people who care. "This idea of the soil drench is getting people excited. It's not meaningless and it's not purposeless either. So, let's just see where it goes."

One world might be ending, but in the meantime, there's still so much left to do: food to ferry around to the hungry and needy, children's music concerts to attend, and buckets of phosphite to pour into the soil. At the very least, I can do that and help others pay attention to nature too. Love will need to be a necessary part of this equation, that much I do understand. It's like that parable inspired by Loren Eiseley about throwing starfish back into the sea. *Does it make a difference?* the narrator asks the young girl throwing yet another starfish back into the sea. *Well, it made a difference for that one,* she says. From the perspective of at least *that one*—one forest, one stand, one beech—perhaps our love won't have been for nothing.

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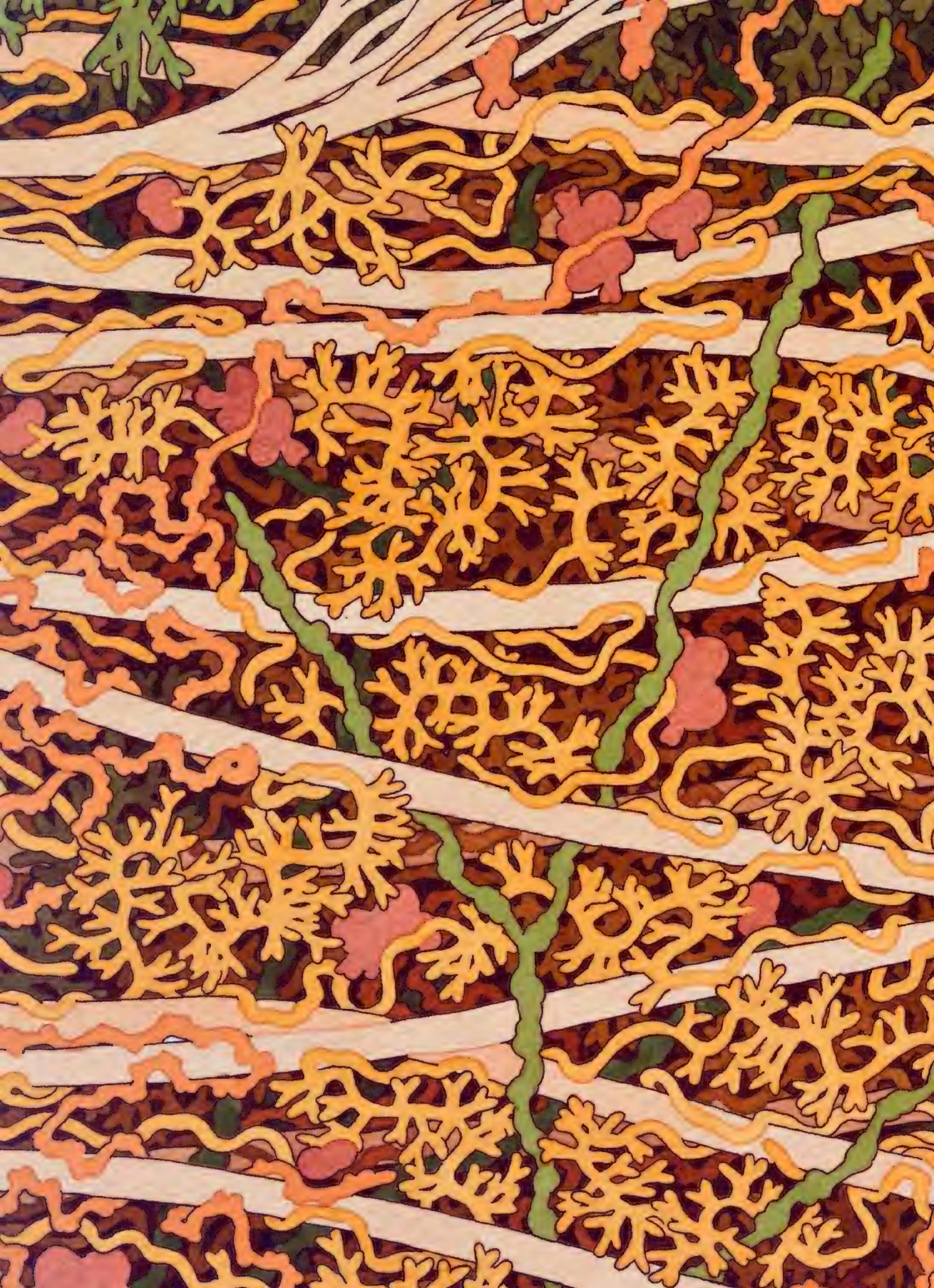
VISUAL ESSAY

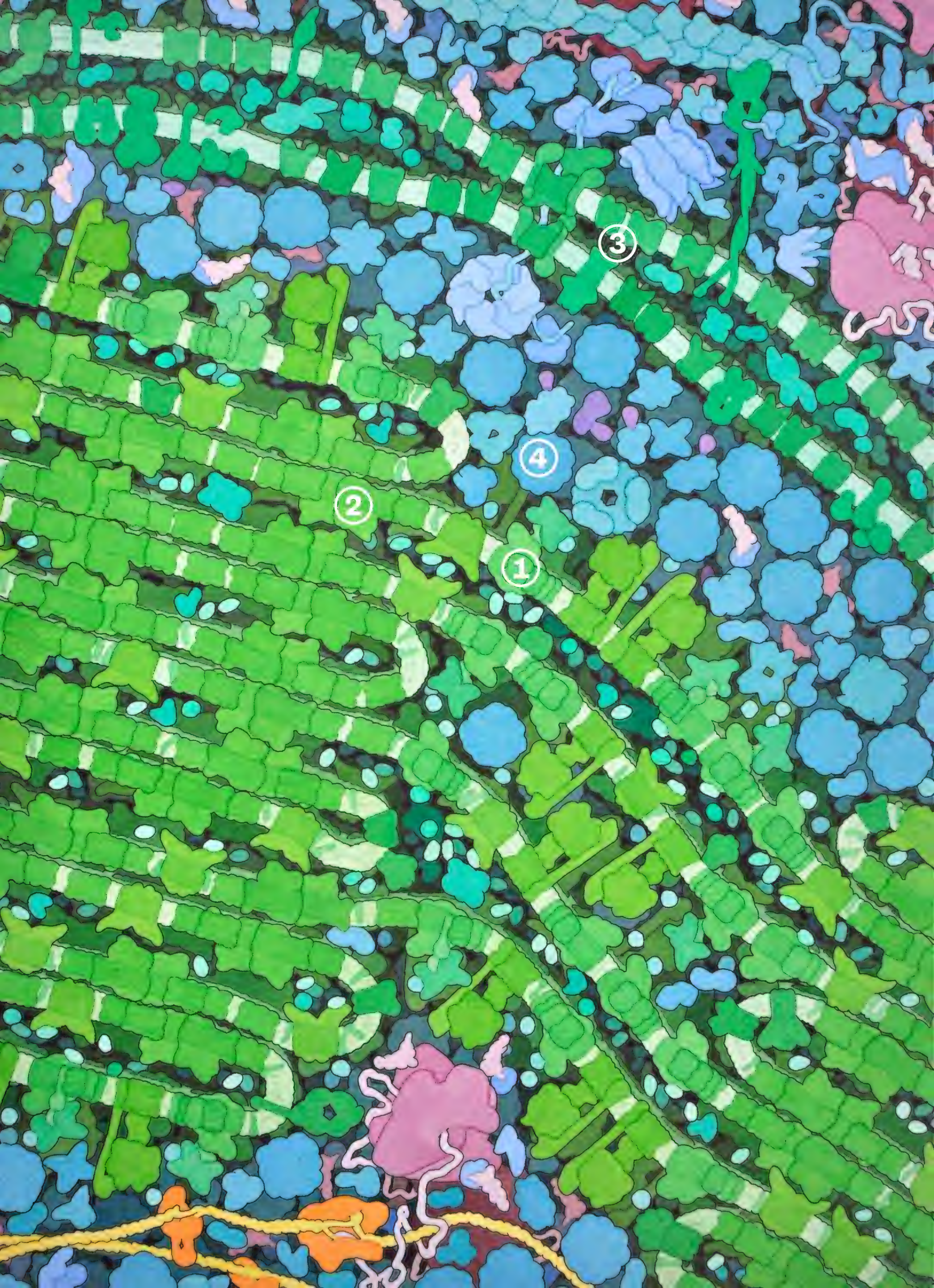
In the Forest of Molecules

The Art of David Goodsell

Like many of his colleagues, structural biologist David Goodsell uses computation to visualize how molecules interact in living organisms. Distinctively, Goodsell also makes paintings of these interactions—"mesoscale molecular landscapes," as he describes them—depicting the realm where molecules come together at nanometer scale to build living cells and tissues. Phenomena at these scales aren't truly "seeable" in the usual sense, as they're smaller than the wavelengths of visible light our eyes use to resolve images. Scientists have developed diverse ways of seeing and knowing at molecular scale: electron microscopy, crystallography, spectroscopy, chemical and genetic assay and, increasingly, computational modeling. These methods interact with molecules in different ways, at different scales, yielding a wide array of data, which Goodsell interprets and synthesizes in paintings like the ones you see here.

In the worlds that trees make, this mesoscale matters. It's where the chemical exchanges of root tissues and endomycorrhizal fungi take place, the garden where the complex molecules useful to humans and other animals are nurtured. As in Darwin's image of the tangled bank, Goodsell's botanical mesoscale is a landscape of "elaborately constructed forms, so different from each other, and dependent upon each other in so complex a manner." His images here take us deep within living plants, depicting the manufacture of cellulose comprising plant cell walls and the quantum-driven exchange of energies that happens with photosynthesis in the grana of chloroplasts.

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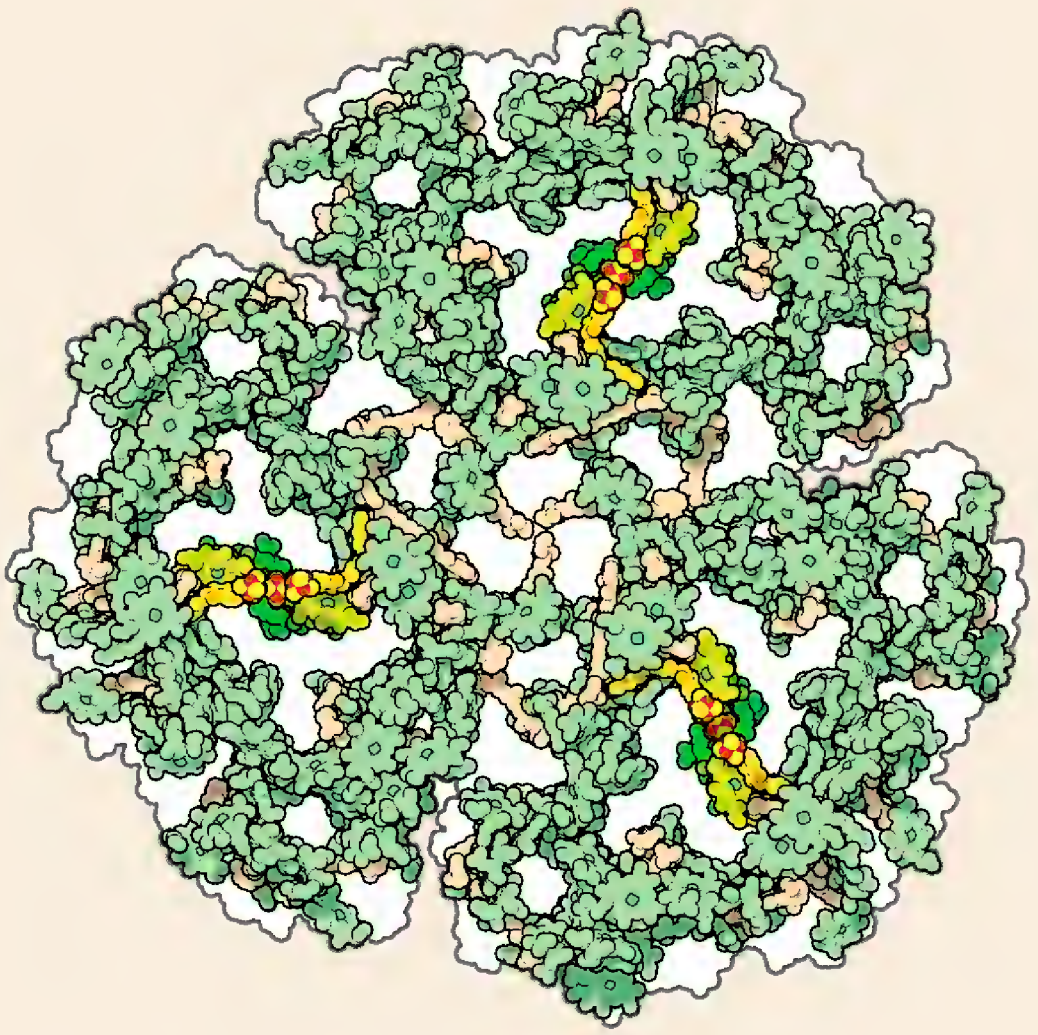
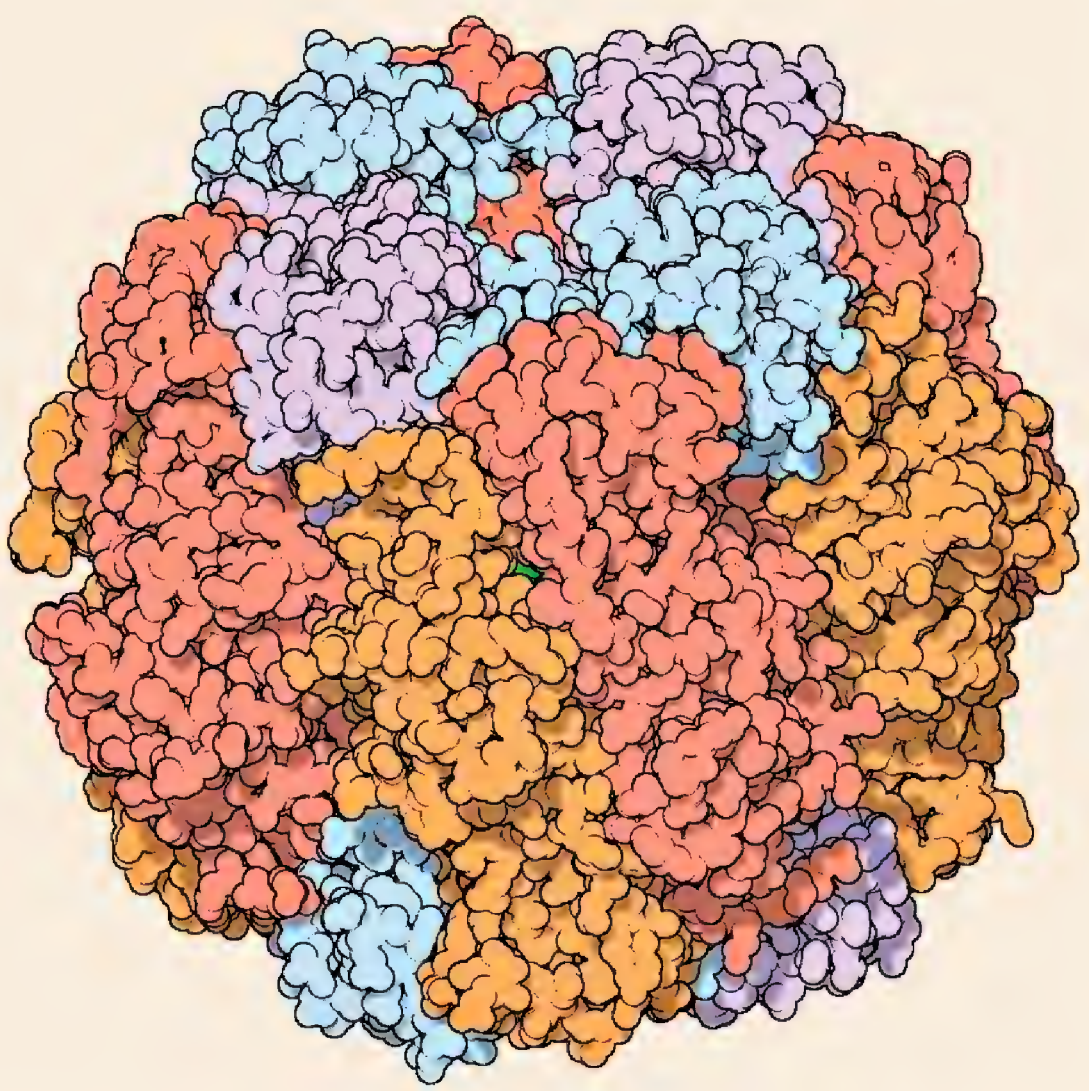


Reaction centers use arrays of chlorophyll and carotenoids as antennae to capture light (left), using the gathered energy to harvest electrons from water molecules, freeing oxygen for us to breathe. The electrons are used to to power metabolism, and eventually are passed along to enzymes like RuBisCO (4 at far left, enlarged below), floating free outside the grana, which uses them to build sugar from water and carbon dioxide.

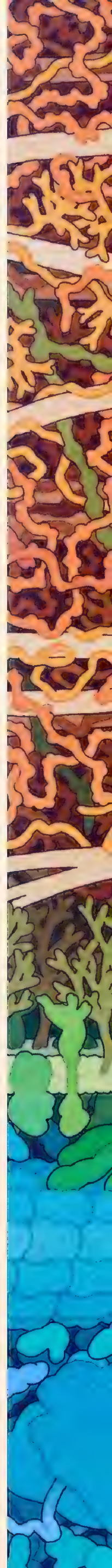


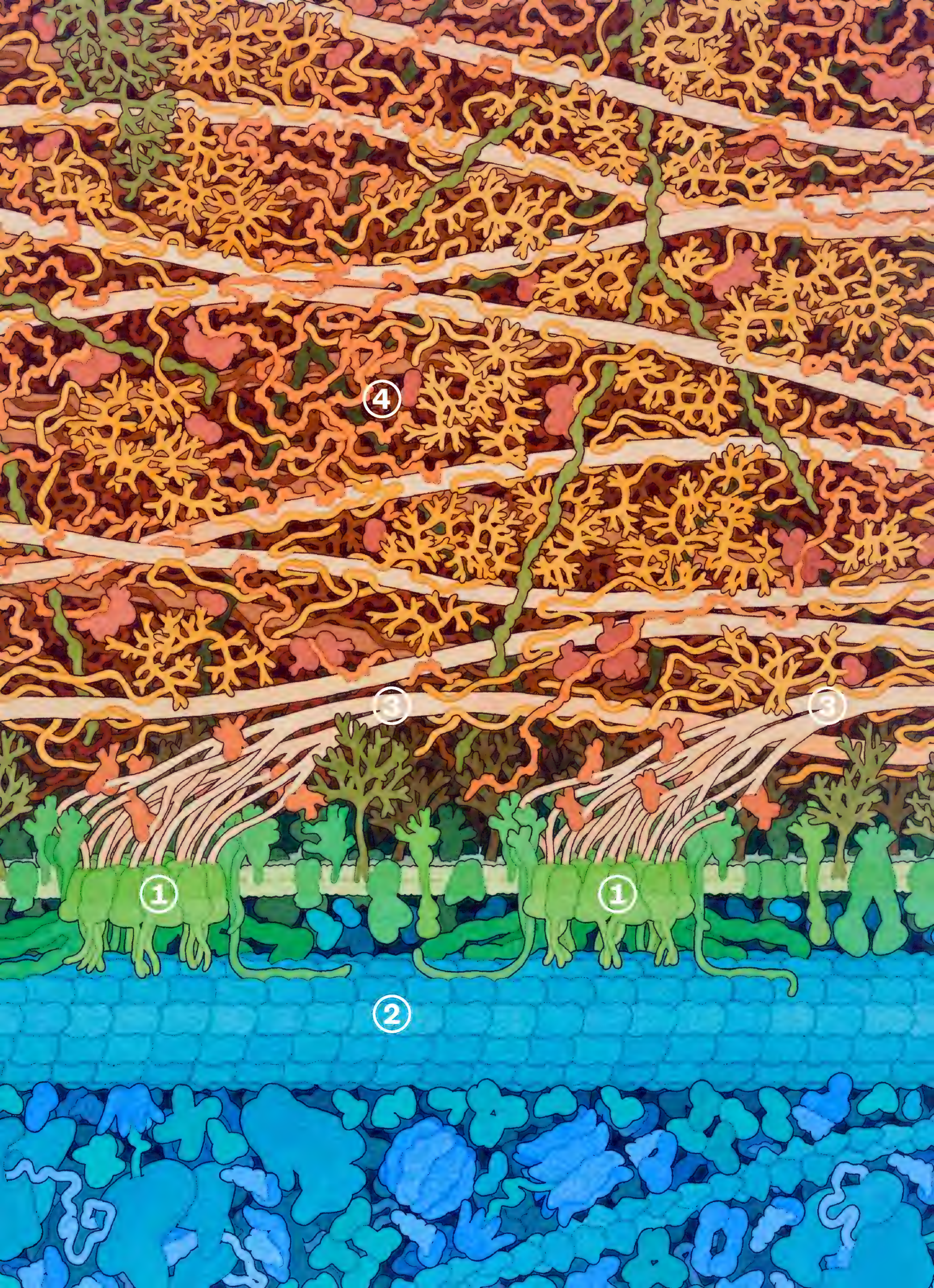
Chloroplasts began their evolutionary journey when free-living cyanobacteria took up residence in a single-celled organism more than 1.5 billion years ago. Here, we're seeing into a chloroplast in cross-section, its photosynthetic machinery arranged in a dynamic framework of stacked and folded membranes called grana. Two kinds of reaction centers (1 and 2) stud these membranes, each one a knot of densely interwoven proteins braided with chlorophyll and other colorful molecules using sunlight to harvest electrons from water. Toward the top of the image, a two-layer outer membrane (3) marks the boundary between the chloroplast and the broader environment of the cell's interior. Interspersed within this membrane and among the grana are enzymes and proteins that generate, store, and harness energy captured by photosynthesis. At the bottom of the page, RNA polymerase, mRNA, and a ribosome (orange) interact with DNA from the chloroplast's own genome (yellow)—a reminder of its origins as a free-living organism.

The words “cell” and “cellulose” share a common origin. The material was named for the structures they form, now called “cells”—the term Robert Hooke coined in his *Micrographia* (1665) to name the smallest structures he could see through his microscope. In plants, the chief material and structural ingredient of this intercellular matrix is cellulose, making it the most abundant biopolymer in the world. Perhaps only limestone outstrips its sheer magnitude as a material produced by living organisms.

The cell wall is very far from being a simple, monolithic slab of cellulose, however. In the painting at right, the exterior of the cell lies beyond the top margin of the image, with the cell membrane and the jumbled systems of the cell’s interior in greens and blues at bottom. The boundary between membrane and wall is lively, productive, tensed with the straining forces of polymer production. The membrane is studded with proteins able to transmit molecules into and out of the cell. It is also the substrate where the synthesis of cellulose unspools. Regularly spaced here, streams of the polymer emerge among the tangled proteins and carbohydrates of the cell wall from collars of cellulose synthase (1), which fuse them together like strands woven in a rope loom. The cellulose synthase structures are moved into place and supported by microtubules—cylindrical polymer beams, which act as a transit system and structural element, like girders and tramways threading through the cytoplasm. Here, a microtubule (2) is the basis of a molecular assembly line, fixing and supporting the cellulose synthase arrays. As the strands of cellulose spout forth (3), they interweave with pectins, xyloglucans, and other branching, long-chain carbohydrates (4)—including lignin, which in trees combines with cellulose to make wood.

DAVID GOODSELL *is Professor of Computational Biology at the Scripps Research Institute, and Research Professor at Rutgers University, where he is Scientific Outreach Lead at the RCSB Protein Data Bank.*




4
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Propagations

SMALL WORLD

West Mount Airy Canopy

Anthony S. Aiello

My family and I live in the leafy West Mount Airy neighborhood of northwest Philadelphia, largely developed between the arrival of Victorian commuter lines and World War II, but with a smattering of houses showing its early nineteenth century rural beginnings. When I walk down my front steps, by turning left or right I can quickly move from one local watershed to another: the Monoshone Creek and Carpenter's Run. Each of these merges with the Wissahickon Creek, famous locally for its eponymously named schist, and each watershed provides clues into the arboreal history of northwest Philadelphia.

Our neighborhood is known for its high percentage of canopy cover, and at first glance, it may not seem much different than other semi-urban neighborhoods, with much of this cover intentionally planted over the past 100 years. But what distinguishes the neighborhood are the naturally occurring remnant forests that in some cases are obvious, and in others a less transparent component of the urban canopy. The diversity of houses also distinguishes the neighborhood, and includes large single houses with ample yards, a mix of semi-detached houses of varying styles (some with space around them and others crowded together), and tightly packed row houses. In addition to this diversity in style and density, there is a wide range of age diversity, with occasionally eighteenth and nineteenth century vernacular farmhouses, early Queen Anne and Italianate "commuter" houses from the late 1800s, a large mix of pre-World War II houses of varying styles, and even some more contemporary additions.

When turning right from our front steps, and heading to the crest of our block, I quickly enter Carpenter's Woods, a watershed separate from the one in which we live. The story told by Carpenter's Woods—with its canopy of mature Eastern hardwoods contiguous with the larger Wissahickon Valley Park—is perhaps more obvious than that of the rest of the neighborhood. Likely forested in the eighteenth century, these woods were preserved in the early twentieth century when they became part of the Philadelphia Parks system because of their importance to a diversity of resident and migratory bird species; today, they remain part of a network of places recognized for its value to bird conservation. The preservation of Carpenter's Woods also reflects a difference in land ownership since the 1700s, it being comprised of a few large parcels in comparison to smaller individual landholdings in adjacent areas.

Carpenter's Run courses through these woods as a free-flowing stream for almost its entire length. This run, a headwater whose drainage boundaries are well defined by the intact canopy of Carpenter's Woods, gives the woods a distinctive panhandle shape reminiscent of Oklahoma. It is fairly clear that the woods and its watershed are closely the same, and so it is fairly obvious to understand the drainage area of this watershed. Here you will find a mix of eastern hardwoods: large tulip trees (*Liriodendron tulipifera*), white oak, chestnut oak, and black and red oaks (*Quercus alba, Q. velutina, Q. rubra,* and *Q. montana*), an occasional hickory (*Carya cordiformis*), American beech (*Fagus grandifolia*), sassafras along its edges (*Sassafras albidum*), black cherry (*Prunus serotina*), Eastern white pine (*Pinus strobus*), red maple (*Acer rubrum*), black birch (*Betula lenta*), sycamore (*Platanus occidentalis*), blackgum (*Nyssa sylvatica*), and white ash (*Fraxinus*

Illustration by Ellen Weinstein

americana). Some of these are massive and demonstrate their ages, while others (in particular the white oaks) have sizes that belie their age. Core samples of white oaks, blackgum, and tulip trees all show these to be over 200 years old, providing real evidence to go along with observations about the ages of these trees. These mature trees show other hallmarks of their age, with low stem taper, crowns with thick twisting limbs, and lower trunk bark balding. Mixed among these are non-native trees such as Norway maple (*Acer platanoides*), sweet cherry (*Prunus avium*), and crabapple (*Malus*). The understory is a combination of native and non-native shrubs, including spicebush (*Lindera benzoin*), common witchhazel (*Hamamelis virginiana*), occasional American hazelnut (*Corylus americana*), plus a rogue's gallery of Asian viburnums (*Viburnum sieboldii, V. plicatum*), Japanese holly (*Ilex crenata*), Oriental photinia (*Photinia villosa*), and Japanese aralia (*Aralia elata*).

Among the houses within the Carpenter's Run watershed, numerous remnant oaks and tulip trees infiltrate the front and back yards; in some cases, a lone tree occurs in an odd location in a front yard, or far too close to a house to have been intentional. I have often wondered how these trees survived house construction before reminding myself that the trees were half their age during construction, and thank the foresighted builders who preserved them. When envisioned from above, what emerges is a dense canopy of mature forest in Carpenter's Woods with strands of pre-suburban trees filtering through the surrounding neighborhood.

Turning left from our front steps reveals a much different story, where the neighborhood is fully developed and the clues to its botanical history and limnology are less obvious but equally rewarding. This part of my neighborhood lies in the Monoshone Creek watershed, a stream that forms a broad valley and encompasses much of our West Mount Airy neighborhood. The Monoshone itself runs in culverts under Lincoln Drive, though few visitors will realize it while careening along this drive, which was built as part of the city beautiful movement in the early twentieth century. As a result, the mature trees that populate the Monoshone drainage are less obvious, but parsing these remnants over the years has allowed me to understand the watershed's history.

Parsing these remnants over the years has allowed me to understand the watershed's history.

In the few blocks directly across from our house, massive white and black oaks are peppered among the 1920s houses of the neighborhood. These oaks are similarly an extension of Carpenter's Woods, and provide habitat for many bird species that we watch from our front porch, with my favorites being the variety of woodpeckers, including regular visits by pileated woodpeckers. Strangely, during the depths of the pandemic lockdown, a lone wild turkey ended up perching in the oak across from our house, a sight never seen before or since. And as common as they are, I am astonished by the squirrel dreys, the ultimate tree houses, often scores of feet in the canopies. In mast years we fall asleep to the drum-beat of acorns bouncing off of car roofs, and walking to our car is like being in a sea of marbles, reminding me of a slapstick comedy. People ask me what can be done with this ocean of acorns, which form a thick flour in the street when crushed by cars, and I often think of a cottage industry of Mount Airy *prosciutto,* raised on local beech and oak.

A walk along Wayne Ave, a former trolley (and current bus) route, which makes its way from Lincoln Drive up to the edge of Carpenter's Woods, traverses the full height of the Monoshone catchment. The mix of houses along this road are typical of the neighborhood, but walking downwards from the crest of the hill, a scattering of mature trees are remnants of the larger forests that must have once covered this area. Mature red oaks, white oaks, and black oaks, along with massive tulip trees, grow among a mix of large single-family and smaller semi-detached houses. At certain points you can catch glimpses across the Monoshone Valley and see a similar mix of mature trees on the crest of the opposite hillside.

Anthony S. Aiello is the associate director for conservation, plant breeding, and collections at Longwood Gardens in Chester County, Pennsylvania.

Untamed fragments of the Monoshone Creek appear occasionally as free-running tributaries, serving as reminders of how this landscape appeared before the spread of commuter railroads and houses filled the landscape. In one case, a few aging specimen trees around a large multistory apartment building indicate the grounds of a former estate. A small stream runs through the property before being consumed by a mass of bamboo and then disappearing under the street. Similarly, at the Germantown Unitarian Church, where mature white oaks and tulip trees dot the top of a hill and its slopes, a narrow tributary appears through a remnant woodland and then is subsumed beneath Lincoln Drive.

Numerous houses line Lincoln Drive, in the floodplain as it were, and their rear-neighboring houses sit at least a full story higher, being built on a sharp bank above the Monoshone. From the ground floor of these higher houses, it seems that you can see directly into the second floor of their neighbors, an odd artifact of the local geography. It is along one of these sharp banks that a grove of mature blackgums is interspersed among several houses. On a recent late summer morning I happened to walk by as a blush of robins was making their annual feast on their fruits.

As Willie Nelson sings in "Yesterday's Wine," "miracles occur in the strangest of places"—I think of this line whenever I see the massive, ram-rod tulip trees and American beeches that occur in odd locations, close to houses and in backyards. Again, I can only surmise that these trees pre-date the houses that they shade, and were kept while the neighborhoods were developed.

At one of these houses along Lincoln Drive, a colossal sycamore grows mostly obscured in the backyard. This tree is far out of proportion for the space it occupies and grows on what appears to have once been the streambank of the Monoshone Creek. In the side yard of a nearby house are a grouping of four large, single-stemmed sycamores, growing in an oddly rhombic pattern. I can see no reason why anyone would have planted this pattern intentionally and

> In mast years we fall asleep to the drum-beat of acorns bouncing off of car roofs, and walking to our car is like being in a sea of marbles.

can only surmise that they are old basal sprouts from another large sycamore that once grew along the Monoshone. Away from these "creekside" sycamores, on opposing sides of the stream valley, are two sentinel white oaks, their positions marking what was once the transition from floodplain to upland. These two oaks, growing nonchalantly in the side and front yards of their respective houses, have witnessed the transition from forest to rural landscape to suburban development.

Having lived in this neighborhood for nearly 25 years, my deeper understanding of its botanical history began to clarify during the Covid shutdown, which allowed me the luxury to study my neighborhood more closely. Having the time for long walks and contemplation revealed previously unseen patterns and provided a welcome lesson in the value of observation leading to revelation.

CULTIVATION

Ask the Trees

"Ask the trees how they want to be cared for; they will teach you better than books."
—Friedrich Pfeil, German forester and educator

By Kent Honl

I became an arborist not only because I loved trees, but because I was intensely curious about them—a curiosity I strive to encourage in my students. I had no intention of becoming a teacher, however, and fell into the role almost by accident. I had served once as a co-instructor for a half-day pruning workshop at Hennepin Technical College in Brooklyn Park, Minnesota, so I was familiar with the institution when they emailed to see if I might be able to step in on occasion as a substitute instructor. When I went to campus to discuss the arrangement with the Dean, she and two other faculty members asked if they could interview me for an adjunct faculty position. It felt a bit like an ambush, but I was game for it.

The interview went smoothly, and soon the Dean called me to ask If I would accept the position. I said yes before allowing myself time to think it over. She next asked if I could start on Monday the following week. It was already Thursday, so I spent the weekend frantically outlining a curriculum for an "Arboriculture I" course.

Ten years later, I still use the main outline of that curriculum, though the details have evolved as I learn from students

Illustration by Lucy Jones

what leaves a lasting impression for them. Participants in my courses include not only aspiring arborists, but also students of nursery production, landscape design, and construction. Reaching a broad audience at the beginning of their careers is critical, since the "Green Industry" includes several separate disciplines with goals that do not always complement each other. Arborists are most often called on to address problems at the very end of a chain of events that did not support long-term tree success. In hopes of limiting such emergencies, I encourage all my students to "think like an arborist," no matter what discipline they pursue.

There are three pillars to my teaching approach: inquiry, experiential learning, and critical thinking. Let's look at each of them.

Inquiry

On the first day of the semester, students are surprised to learn that I do not write the final exam for the course—they do. Each student is required to generate at least two questions per week based on their readings of assigned chapters in the course text, the ISA Arborists' Certification Study Guide (currently in its fourth edition, 2022). I want the students to demonstrate the kind of engagement with the subject matter that they would never get passively listening to lecture-based instruction. Student-generated questions are often useful for weekly discussions during the semester. At the end of the semester, I assemble the most useful questions into the final exam for the course. A well-written question might have several plausible yet incorrect answers and will require genuine understanding of the topic to discern which is right. Questions that demonstrate insight and a dose of humor always capture my attention.

Crafting good questions takes practice, but the practice fosters a state of inquiry: an open, curious mindset that can keep a person vital throughout life. The quality of the questions we pose determines the quality of our lives and the kinds of answers we get. We live in a culture that seems to value telling more than listening. We are constantly bombarded with advertising and social media trying to persuade us of something or other. A state of inquiry builds listening skills and can make us better arborists and better people. A good arborist needs to listen to the trees just as much as they need to listen to people.

> A good arborist needs to listen to the trees just as much as they need to listen to people.

Experiential Learning

Students who come to technical colleges are interested in hands-on education; they want to learn how to do things, not learn about things. Experiential learning accommodates a variety of learning styles. The more senses are involved in a learning activity, the deeper it sinks into memory. We do as many outdoor, hands-on projects as possible during the course, given the shifting seasonal weather and light conditions of autumn in Minnesota. As an adjunct faculty member with access to the resources of Rainbow Tree Company, I bring in colleagues as guest speakers, along with machinery such as the Air Spade for demonstrations. We spend several class sessions learning about proper planting techniques by tearing apart ball and burlap nursery stock to look for the location and condition of the root flare before planting.

Kent Honl has worked for Rainbow Tree Company in Minnetonka, Minnesota since 1994, and serves as an adjunct faculty in the Landscape Horticulture program at Hennepin Technical College in Brooklyn Park, Minnesota.

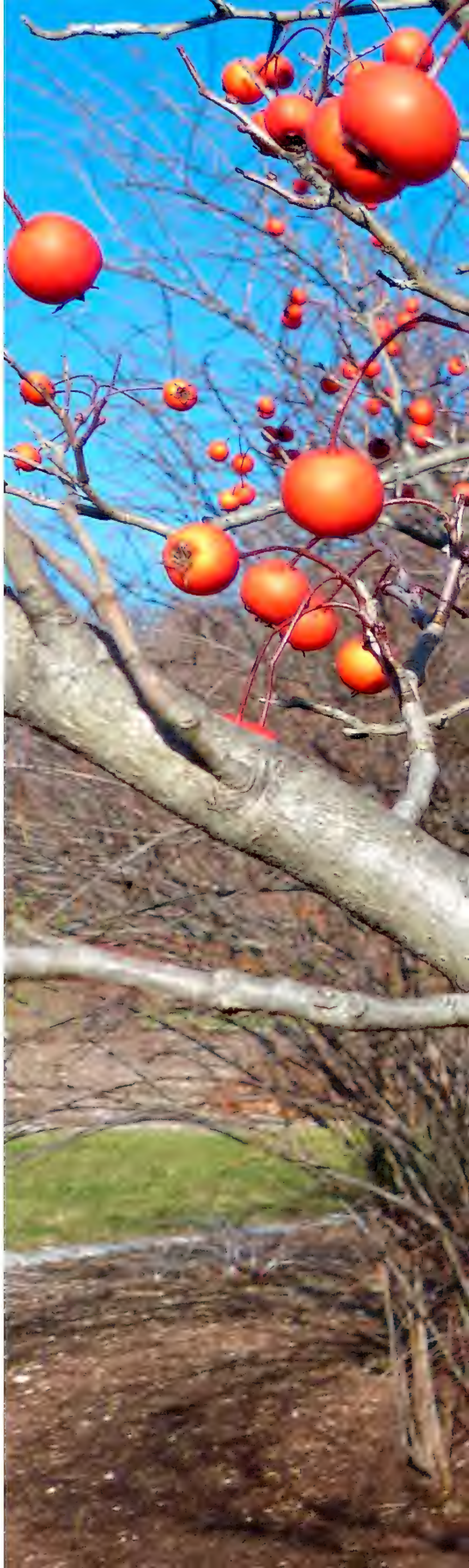
Students also take part in a lab session simulating oak wilt, in which they need to generate a site plan to respond to a hypothetical outbreak of the pathogen on campus.

As the fall semester progresses, the days shorten, and the weather becomes less conducive to outdoor activities. The class then turns its attention toward completion of the semester project based on the CODIT process (the model posited by Dr. Alex Shigo for the Compartmentalization of Decay in Trees). Each student is required to build a physical model of the CODIT process, and present their work to the rest of the class. Their creativity is impressive and inspiring. I have seen students make embroidery projects, cakes, and charcuterie plates, all depicting the way trees compartmentalize wounds and decay.

Independent, Critical Thinking

The mission of Hennepin Technical College is to provide career training, paired with critical thinking skills. We live in a society awash in information and disinformation, and have drifted into polarized identities, with little real exchange between different groups. The classroom offers a great opportunity to address some of these issues. Each semester, we spend an entire session on a wide-ranging discussion of invasive species. Ahead of class, students write papers in response to prepared questions, and we establish ground rules for the discussion. The aim is not to arrive at any pre-determined conclusion about management of invasive species, but to clarify values and be able to speak from them in a civil and productive manner.

It has never been easier to find endless information at our every whim, but how do we sort the good from the bad? In class, we delve into the topic of scientific literacy and learn how to evaluate validity of information. It is worthwhile for all of us to consider some of these questions: How do we know what we know? What can we trust? What are my values and how do they serve as a basis for my actions? These kinds of questions matter not only for success in arboriculture, but for citizenship in complex times.



Hawthorns in December 2016, their fruit "a berserk shade of red." *Crataegus viridis* 'Winter King', accession 368-2012*A. *Photograph by Bob Mayer*

ODE TO TREES

By James Parker

Autumn in England. Autumn in big-sky arable Essex, to be precise, where I'm staying with my parents for a couple of weeks. Bonfire smoke ghosting the hedges. Changeability, abnormality. Weird prickling temperateness. Sky-flash of rainwater in the wheel-rut. Exhalation of earth-dust behind the tractor. Twilight, and the heron flaps heavily past the jeering ducks.

I get bored, sang Bauhaus's Peter Murphy, *I do get bored/ IN THE FLAT FIELD.* I love that song. But I don't get bored. The flat field, recently drilled with next year's crop, is where I might catch the profane silhouette of a hare: his tawny length, and the flicked V of his ears. The flat field is where I might see a scooting muntjac, vermin bundle on short deer legs. The Duke of Bedford brought a couple over from China in 1838, and now they're everywhere. They cough like old men but they panic like mice.

And then there are the trees. Tall ash trees with swooping curves, a mob of haggard nettles at their base. Hawthorns in the hedges, their berries a berserk shade of red. Priestly willows. Beech trees infected by autumn, those first dabs of ginger in the green. The oak, ablaze with his own energy, warped by his own interior heat. The chestnut, many-chambered, tolerant host of the moodswing-ing wood-dove. Noble, soul-improving trees; scraggly-ass malicious trees. Trees with antlers. Trees with fists. Trees that a painter might like, filtering the distance that peals across the fields. Memory trees. Phantom elms, killed in the '70s by Dutch Elm Disease, their crowns full of long-dead rooks. Trees like brains that are stirred to thought by the wind.

There was a time in my life when if I looked, really looked, at a tree, I'd experience a tinny, middle-class version of the famous encounter in Sartre's *Nausea,* when the root of a chestnut tree gives the narrator a panic attack: "I couldn't remember it was a root anymore. Words had vanished and with them the meaning of things, the ways things are to be used, the feeble points of reference which men have traced on their surface. I was sitting, stooping over, head bowed, alone in front of this black, knotty lump, entirely raw, frightening me."

That time has passed, thank God. My journey out of it was long and complicated and not particularly interesting, unless you're me. The trees, of course, never went anywhere.

JAMES PARKER *is a staff writer at* The Atlantic. *His book* Get Me Through the Next Five Minutes: Odes to Being Alive *will be published by W. W. Norton in June 2024.*

Transition to Cold Storage

By Emily Hitchcock,
Greenhouse Gardener

Every November, the plant production crew moves our containerized plants into the cold storage building for the winter. There, the plants are kept just above freezing and sheltered from harsh winds and snow, until it is time to take them back outside in April. Unlike the plants in our in-ground nurseries, these potted plants don't have insulation around their root systems and could therefore be killed by freezing temperatures if kept outside. The cold storage building also refrigerates the plants during unseasonably warm winter days. An environment of complete darkness sends a strong message to the plants that they are meant to be hibernating.

Before the plants are brought inside, we remove their remaining leaves in order to prevent the collection of leaf litter inside the building, which could harbor disease. The introduction of rolling plant shelves—in place of stationary ones—transformed the moving process and made watering easier as well. The entire collection is checked for water once a week and monitored for pests and diseases. After three or four cycles through this winter moving process, these plants will graduate to the landscape, where they will experience a real Boston winter.

Photograph by Jamila dePeiza-Kern

1,000
Approximate number of plants in cold storage

34–36° F
Storage temperature range

The ARNOLD ARBORETUM of HARVARD UNIVERSITY
125 ARBORWAY
BOSTON, MA 02130-3500